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VOLUME XXV — *Second Quarter, 1958* — NUMBER 2

CONTENTS

Growth and Development of the Child, *Granville C. Fisher, Ph.D.* . . 99

Pulp Amputation and Healing, *David S. Berman, B.D.S.* 84

Unit News 105

Of the Mortality of Young Children at the Time of Teething—Part II . 116

Abstracts 126

Space Maintenance, *David B. Law, D.D.S.* 130

The Role of Children's Dentistry in the Next Decade, *John C. Brauer, D.D.S.* 135

The Finger Sucking Habit and Associated Problems, *T. M. Graber, D.D.S.* 145

25th Anniversary of the New York State Society of Dentistry for Children 152

Internal Resorption or Caries? *J. Randle Luten, Jr., D.M.D.* 156

Aids in Pedodontic Prosthodontics, *Oscar E. Beder, D.D.S.* 160

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Growth and Development of the Child*

GRANVILLE C. FISHER, PH.D.**

EDITOR'S NOTE: *Do you know what marasmus is? You'll find it clearly defined in the accompanying article by Granville Fisher. And although you will not have the advantage and pleasure of seeing Doctor Fisher present his paper in his own provocatively interesting manner, you'll find the next 33 minutes well spent in reading his material.*

Dr. Fisher received his basic education and Ph.D., at the University of Chicago and for several years was psychologist for the Criminal Court of Cook County, Illinois, coming to the University of Miami in 1946.

This is the second paper by Doctor Fisher which has appeared in our JOURNAL *(1st Q-1955), and we'll wager you'll enjoy and be educated further by this one, too.*

A. E. S.

WE could speak of the physical growth and development of the child, and of the psychological growth and development. Actually, in the light of contemporary research, to speak of either one to the exclusion of the other, or as though they are separates, is to present a distorted picture of what seem to be the facts. With greater confidence than ever, we can state today that all psychology stems out of biology—that the substance of living tissue is protopsychic as well as protoplasmic. Conversely, this same living tissue in its growth, maturation, and physiology is subject to modification through the impact of psychologic processes.

The experience of birth introduces many elements of stress. The postnatal environment, although it offers wider horizons and richer experiences, is also threatening and painful in many ways.

From a state in which he was actually a parasite, attached to the host mother by the placenta, the infant moves toward a state of increasing independence, but at what a price! The weight of new responsibilities, of adaptation to changing temperature, postponement of need satisfaction, energy expenditure in respiration and feeding, and the multitudinous complex learning tasks ahead, might well give rise to a conflict between the desire to mature as a self-directing and adequate individual on the one hand, and a return to prenatal irresponsibility or state of dependency on the other. Certainly something of this conflict will characterize the individual throughout the remainder of his life.

TENSION-RELIEVING ACTIVITIES

Tissue Tension

When the food stores and the water content reach a certain point of depletion, and this continues for any length of time, then actual tension develops in the tissues. However, it is not only depletion which causes tissue tension. The accumulation of waste products, unusual pressure, or actual tissue damage, experienced very often as pain, and certain glandular secretions, especially the

* Presented at the Tenth Annual Meeting of the American Academy of Pedodontics, Miami Beach, Florida, October 30, 1957.

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hormones of the sex glands—the gonads —also cause tension in the body tissues.

Basic Drives

Whenever the tension in the tissues of a human being reaches a certain level, that is, whenever there is sufficient protoplasmic irritation, the organism begins to move. The movement is originally random and undirected. But the organism *moves*. This is the significant point in the present discussion. We note that whenever an ameba is stimulated, or put in a state of tension, or irritated, it moves. This phenomenon established the concept of the irritability of protoplasm. A human individual is made up of protoplasm; complex to be sure, but protoplasm nevertheless. When this protoplasm is placed in a state of tension, when it is irritated, it moves.

A lack, want, or need in the person will give rise to tissue tension, and hence will set the individual into motion; that is, it will *drive* him to be active. Thus, when the stomach cavity becomes empty, when the tissues of the body are not adequately supplied with food, this depletion is reflected in the stomach contractions and certain chemical changes in the blood-stream which create situations of irritation and tension. This, in turn, sets the organism into motion; or *drives* it into activity. This, then, is termed the *hunger drive*. Similarly, water deprivation will set up a *thirst drive*. The accumulation of waste in the colon or the bladder through the protoplasmic irritation caused by distention creates an *excretory drive*. The hormone secretions of the gonads set up a *sex drive*.

Motivation

Motivation is the name we give to the study of this movement of an organism and of the causes of this movement, when it is directed toward definite aims. Much, perhaps even most, of human behavior will be efforts to relieve such stresses.

We must be careful, however, and not assume, as some have, that all human behavior is an effort to relieve such states of tension. Actually, the developing human will often engage in activities which as *states of tension* are experienced as enjoyable—dancing, water-skiing, hunting, fishing, and such.

Perhaps earlier investigators were led into error because of the unfortunate choice of a word. What has been termed *irritability of protoplasm,* the writer prefers to call *excitability*. Irritability carries the connotation of unpleasantness. Excitability may connote unpleasantness *or pleasantness*. We suspect that our theories of motivation have been influenced by the concept of protoplasmic *irritability* and its connotation of unpleasantness. Thus, motivation was regarded as an effort to remove the irritation and return to a state of relaxation and rest. When we exchange terms it will enable us to include drive directed toward the excitement of protoplasm or tissue, since excitement in some instances is experienced as pleasant and desirable.

For example, we can examine the protoplasmic *excitability* of the sense organs. The human utilizes vision not just for the avoidance of pain and for the restoration of tissue depletion or reduction of stress. He sometimes views just for the pleasure of viewing. The excitement of visual protoplasm is often sought as a rewarding experience in itself. Color, line, shape, form, arrangement, design, may all come to provide exciting visual experiences that will be sought just for the sake of that visual

excitement. The same can be said for the stimulation of auditory protoplasm. Consonances and harmonies of sound give pleasure as music. Certain excitements of the taste protoplasm and of the olfactory protoplasm are pleasant in themselves; for example, sweets and perfumes. The excitement of the protoplasm of the cutaneous senses is also often sought for the satisfaction that it provides immediately. Petting, stroking, rubbing, and scratching the back can all be enjoyed, not because they reduce an existing protoplasmic excitement, but rather because they generate one.

Initial Resources Within the Infant

The infant comes with a few *reflexes* which will operate upon adequate stimulation. Air striking the lungs, assisted by a few spanks on his posterior, will ordinarily start the *breathing reflex*. A variety of stimuli applied to almost any part of the body will start the *sucking reflex*. Pressure on the cheek will cause the head to turn in the direction of the pressure. Under these circumstances the nipple is soon taken. The presence of bulk in the throat sets off the *swallowing reflex*. And thus the first food is ingested. The process of digestion is now initiated.

The process is not always so simple. The reflexes do not always operate with efficiency. Sometimes the infant has to *learn* to swallow, and has to *learn* to retain the food in the stomach once it has been swallowed. Quite often it comes right back out. But in most instances, the infant is soon on his way to an efficient process of ingestion and digestion of a single food; namely, milk. He has met his first major problem and has begun to solve it. His correct responses are rewarded by the food in his stomach and the reduction of tension experienced as hunger pangs. His incorrect responses result in the continuation of unpleasant tensions within. He will rapidly learn to repeat the correct responses and to avoid the incorrect ones.

EMOTIONS

The infant comes equipped not only with a set of reflexes, but also with a capacity to react emotionally to various stimuli.

Overall excitability is the first emotional reaction observable in the newborn. Qualitatively, this differs but little from the reaction of the ameba.

Differentiation of this excitability takes place within ten or twelve weeks into two reactions; *pleasant excitement* and *unpleasant excitement*. Toward those stimuli which stir up pleasant excitement, the infant will respond positively; that is, he will seek to gain and to continue contact with such stimuli. Toward those which stir up unpleasant excitement, he will respond negatively; that is, he will try to avoid or break contact with such stimuli.

Emotion as Primitive Perception

Moving toward those stimuli which are rewarding to the organism, and moving away from those which are painful and endangering, are the two reactions basic to survival. Long before animals developed brains and the ability to solve problems on the basis of thinking; long before they could make *judgments* as to the nature of a stimulus; certainly long before the rise of consciousness, they had to have some way to perceive the nature of a stimulus or situation in terms of their own well-being. In a primitive state these perceptions often had to be immediate if the organism were

to avoid damage or destruction. The emotional reaction served this function.

The Emergency Theory of Emotions

As long as the needs of the individual are being met with little or no delay, and as long as situations are not perceived as painful or threatening, there is a minimal demand for action. As the organism learns the solutions to various types of problems, there is again less occasion for the intense, agitated, hit-or-miss behavior. In other words, as long as he has available an organized set of responses that are successfully adaptive to a situation, his actions for the most part will be conservative as regards the expenditure of energy.

When the repertory of available responses begins to be exhausted, or when the press is very sudden or very intense, we speak of this as constituting an *emergency* situation. The *adrenal glands* at such a time will secrete an unusual amount of adrenin (adrenin, adrenalin, and epinephrin all refer to the same hormone) which will act as a catalyst, bringing about a number of physiological changes. These changes are designed to mobilize the energy and the resources of the individual in an unusual way to deal with an unusual situation.

The autonomic nervous system participates in this mobilization. Under its direct control are the heart, the blood stream, the breathing reflex, the liver, the sphincters that close off various body orifices, the iris, perspiration and many other organs and functions. Ordinarily these operate under the control of the parasympathetic division of the autonomic system, and the action is conservative. In the emergency situation the sympathetic component of the autonomic system displaces in large measure the parasympathetic function, so that the normal processes of the organism are disrupted. The digestive processes are inhibited; the sphincters may relax, resulting in urination, defecation and regurgitation; blood vessels in the gastrointestinal region will constrict, while those in the large muscles of the arms, legs, and trunk will dilate, causing a shunting of the blood from the deeper regions to the skeletal muscles; the pupils of the eyes will dilate; breathing will be heavier; the muscles will become tensed; the liver will release glycogen to provide additional fuel for energy; coagulability of the blood will be increased; and many other alterations will take place, all in the service of the emergency. This disruption of normal activities in the face of an emergency is very much like the mobilization of the national resources in time of war, and the disruption of normal economy.

Emotion as Disorganized Response

This disruption of the normal state of internal affairs, together with the lack of smoothly-operating and effective overt behavior, has prompted some psychologists and physiologists to regard emotions as disorganizing. The contrast is made between emotion as disorganized response, and intelligence as organized response. The implication is that the one should be disdained for the other. In extreme cases of emergency it is certainly disorganizing to the normal economy of the psychophysiological processes. However, the function seems to be an attempt at *reorganization* to meet an abnormal stress occasion for which the individual is not prepared.

Emotions as Mechanism

Emotions are not always direct reactions to situations with which one is

faced. They may be utilized instrumentally to gain ends yet in the future. Thus, one may *throw a tantrum,* not so much as a reaction to frustration (although the element of frustration is present), but more as a means of *affecting others* by the emotional display in such a way that they accede to one's demands. So, we will smile and be gay in order to make ourselves more acceptable socially; we will weep and cry to gain sympathy; we will rant and rave in order to frighten others into submission; we will appear timid and fearful in order to bring out in another the desire to be strong and protective, and thus gain his attention and interest. Thus, emotions can be utilized as a mechanism of adjustment; as a means to an end. They can be so used without the user being consciously aware of their instrumentality in his psychological economy.

Importance of Emotional Climate in Infancy

The infant reacts to his world mostly on the basis of his emotional perceptions; and he will perceive his world as safe or as threatening according to the prevailing emotional climate surrounding him.

This should make obvious the imperativeness of a healthy emotional atmosphere in the family. Quarreling and bickering, a lack of expressed affection, anxiety, moodiness, will all be responded to by the infant—*who can perceive the communications of emotion long before those of the intellect make any impression on him.*

Fear, Rage, and Love

The differentiation of an overall excitability into pleasantness and unpleasantness becomes further differentiated into the numerous emotional reactions identifiable in the mature person. Pleasantness will be differentiated into a number of emotions of delight, the most prominent of which will be *love.* Unpleasantness will divide mainly into *fear* and *rage. Love, fear,* and *rage* will be the major orienting emotions throughout the life of the person.

According to the way in which the situation is perceived by the person, it may be approached aggressively in an effort to find a solution. Continued frustration of such efforts may agitate the emotional state until an attack of rage results. If the person perceives the obstacle as beyond his resources for solution; or as actively threatening to his own safety or welfare, and overpoweringly so, the emotional reactions will mobilize the individual for flight, and this reaction will be experienced as fear.

Aggression and rage, then, characterize an emotional state where energy is mobilized for attack; fear, where energy is mobilized for flight.

THE RISE OF THE SELF

Primacy of the attendants. The infant soon learns that in the presence of those in attendance its physiological needs are met, and in the absence of his attendants his discomfort continues. The presence of an attendant soon comes to symbolize the removal of discomfort. Thus, the need for a sense of physical security is met originally only through the ministrations of the attendant.

But more than just the removal of discomfort, the attendant will come to symbolize pleasurable excitation because of being repeatedly associated with petting, rubbing, tickling, and other cutaneous excitations of a pleasure-provoking sort. Association will also be made with vis-

ual, auditory, olfactory, and taste excitements.

The need to gain attention. An overprotracted absence of the attendant gives rise to mounting excitability of an unpleasant sort due to the frustration of the satisfaction of tissue needs and appetites. Anger and anxiety appear to be experienced by the infant. Gradually, the absence of the attendant may become sufficient in itself to generate tension; and the presense of the attendant to reduce it in marked degree. Hence the presence and attention of the attendant will come to be sought as a desirable experience in and of itself.

Attention-getting devices. Since these attendants become perceived as means to an end, and as ends in themselves, the infant organism will tend to repeat those activities which were successful in drawing and holding their attention. In other words, he will develop *attention-getting skills and devices. To be noticed* becomes very important as a means to an end. To be noticed will also gradually become an end, manifesting itself in behavior which is continually saying, "Look at me." To be ignored becomes anxiety producing. To be noticed brings certain satisfaction.

The Need for Self-Enhancement or a Sense of Personal Worth.

Self-enhancement through appearances. The attempt may be made to draw attention to oneself through dress and grooming; that is to say, attention is solicited at the surface, at the boundary. She says "Look at me," when she cuts that evening dress especially low, or when she walks along the beach in the Bikini bathing suit. She says it when she first puts on lipstick, when she buys her first formal. She says it with jewelry and with a silver streak painted in her hair. He says it with a fire-engine-red convertible with leopard-skin upholstery!

Self-enhancement through accomplishments. The need for self-enhancement sometimes takes the more indirect form of "Look at what I can do." And so a great expenditure of energy goes into the doing of things, the making of things, the development of skills in sports and in games; it goes into scholastic achievement, and into other accomplishments, so that in the end, one may say in effect, "Look at what I can do." This "grandstanding" becomes one of the most powerful of motives.

Self-enhancement through character. One may attempt to call attention to those events going on within the boundaries of the person. He may say in effect, "Look at what I am." The emphasis here is on one's character. Nobility, honesty, tenderness, courage, philanthropy, charity, and other virtues may be exhibited in order to gain and hold attention. One may even be a "tough guy" or exhibit a disdain for convention, or he may profess some esoteric or dramatic philosophy if he perceives or experiences such attention-getting.

The need for approval. The infant comes to recognize that somehow or other he is capable of providing pleasure or pain to others; that he too is an agent of satisfaction or dissatisfaction. He learns that things usually go better for him when he is regarded favorably by others.

The please-parent motive evolves out of the sort of sequence we have outlined. In approval one finds security, comfort, goods and services. In disapproval one finds a withdrawal or a withholding of these things, which gives rise to feelings of anxiety, fear, frustration, and anger.

Consequently, "Look at me" soon adds, "and give me some indication that you like what you see." "Look at what I can do" soon adds, "and applaud my performance." "Look at what I am" soon adds, "and accept me as a person; love me."

But approved or not, attention must be gained at any cost. To be disregarded is even more anxiety-producing than to be disapproved. A child will make a nuisance of himself rather than be ignored. If he can attract attention in no other way, he will even resort to some type of behavior that he knows will bring punishment; but with the punishment comes attention, and the attention must be had regardless of cost.

The Super-Ego Function

The new candidate for membership in human society discovers that in seeking satisfactions he is dependent on the ministrations of others, and that he must modify his primitive impulses to conform somewhat to the demands of those about him. In other words, there is a *society* operating on the basis of certain rules and regulations. These regulations go by such names as morals, ethics, mores, taboos, customs, laws, right-and-wrong. A great deal of the approval and the disapproval by the parents are in terms of these social regulations.

To obey the rules, then, provides in some measure a sense of comfort and the expectation of approval and consequent satisfactions. To violate the rules generates anxiety in anticipation of discovery and disapproval and consequent unpleasantness, pain and deprivation.

Shame and guilt are the feelings experienced in a situation of disobedience and anticipated disapproval. To be the target of a shaking finger and such phrases as "Naughty boy!" or "You bad girl!" is directly disturbing. To engage in that behavior which, though undiscovered, would elicit such responses and attitudes if made public, gives rise to anxiety experienced as shame or guilt.

Conscience is the term commonly applied to this reaction. *Super-Ego* is the term which Freud applied to it.

In our own terms we detect the process as being one of primitive perception wherein certain behavior, even though desired by the organism, becomes through experience associated with danger, unpleasantness, and pain as the result of the reactions of others to it. Such experiences have left their residuals in the emotional reactions of the person—in the autonomic reactions—so that when such behavior is now engaged in, or is simply represented symbolically in the unconscious excitations, the internal reactions of the person may take the form of fear, shame, or guilt, such as were experienced in those earlier situations in which the associations were originally formed.

Four Major Psychological Needs

The original biological needs soon have their counterparts in terms of psychological needs. Physical growth, health, development, maturation, and such will depend on certain physical needs being met. Psychological growth, health and maturity depend on these psychological needs being met.

When the needs are met there is a feeling of well-being, satisfaction, and happiness. When the needs are not met there are, in varying degrees, feelings of threat, stress, danger, frustration, and discomfort.

The psychological needs are numerous, but we have arbitrarily designated

four as the great needs, namely; a sense of physical security, a sense of being loved, a sense of personal worth, and the need to make meaning out of experience. How do these affect personality development during childhood?

The need for a sense of physical security. After one year or after five years the human is still in no position to make its own way.

If the personality of the child is to be formed without distortion, then undue or intense anxiety resulting from a threat to its basic physical security should be avoided. He must come to perceive the world and universe about him not as threatening and extremely dangerous, but as realistically adequate to his needs.

The parents of the child will unwittingly or intentionally take advantage of such human needs and anxieties in order to establish control. When the child is sent to bed without any supper, the implicit threat is that, "if you do not conform to our demands, since we control your food supply, we will deprive you of such and you may easily die."

Some parents, hard put to find effective disciplinary devices, have forced their young child to pack his little bag with the threat that he must leave the house and go it alone in the world, because he has not been a "good little boy," or a "good little girl." "If you cannot obey us we do not want you to live here, so you must go." The psychological panic aroused in the child by such a threat can leave emotional scars for life —and we mean *for life.*

Another threat to the physical security of the child is that of physical violence to his person, perpetrated by his parents, by older or stronger brothers and sisters, or by neighborhood and school-ground bullies. Parents in large measure use physical attack upon the child, accompanied frequently by outbursts of temper and rage, as a means of controlling the child. This terrorism may bring about abject conformity in the child. The parent may pride himself that such a child is well-disciplined, well-behaved, obedient, dutiful and respecting. Actually, such a child is frightened and intimidated, and responds on the same basis as a circus animal trained to jump through a hoop at the command of his master. As a personality he is crippled, not by broken bones, but by a broken spirit.

A child is often left to the mercy (or the lack of mercy) of vicious, inconsiderate, or violent siblings, or of bullies outside the family, on the premise that he must learn to fight his own battles. True, he must learn to fight his own battles, BUT NOT AGAINST OVERWHELMING ODDS, NOR IN THE FACE OF INEVITABLE DEFEAT, NOR IN AN ATMOSPHERE OF ABANDONMENT BY THOSE UPON WHOM HE DEPENDS FOR SUPPORT.

The parent should not go out and fight the child's battles for him. Neither should he abandon the child when the odds are stacked too high against him. The child should always have the feeling that when the going gets too rough he has sanctuary and safety within his own family.

The need for a sense of being loved. The child needs more than just a sense of physical security. He needs in addition what has at times been referred to as a sense of emotional security, which for the sake of clarity I prefer to call a sense of being loved. This in a broad view includes the sense of being wanted, of being accepted, of being a part of a

group, the sense of social membership, of personal desirability, of friendship, and companionship, of being one with the gang.

Normally, for the healthy growth of personality, this sense of being loved should be germane to family membership. It should begin with the loving care of the mother and the father. *Modern* parents who avoid rocking and cuddling of the infant, and intimate physical contact in play and in display of affection with the small child, are actually denying him the tutelage he requires in literally learning how to love—how to give and to receive love naturally and safely. *Active affection,* or *expressive affection,* in the home is almost a *must* for an ultimately healthy personality.

The Mothering-need of the Infant

From a variety of sources it appears that an infant needs not only adequate nutrition, physical care and protection, but that he has a need also to be held close in the arms of a warm affectionate person. It seems that there is an emotional hunger just as surely as there is a food hunger.

Marasmus. That an infant can suffer emotional starvation seems to be indicated by the disease *marasmus.* Marasmus is defined in the Medical Dictionary as a general wasting away from unknown causes. As late as 1920 about one-half of the deaths among babies less than one year old were attributed to marasmus. Strangely enough, the incidence was higher in hospitals and institutions where the baby had every advantage of hygiene, diet, and systematic care, than it was among babies born and cared for at home.

It has been since discovered that if the infants born in these hospitals are rocked and petted through the day by their mothers, or by an attending nurse if the mother is unable to perform this function, the death rate drops significantly. Physicians refer to this today as TLC—Tender Loving Care. When denied this attention, the baby often loses interest in feeding, becomes listless, and exhibits other disorders. He loses weight rapidly, and may even die if the situation is not corrected. The reaction in many ways parallels a depressive reaction in an adult.

We have actually seen a person wither up and die apparently for no discoverable reason other than that she felt she was unloved, AND I KNOW OF NO PSYCHOTHERAPY THAT CAN MAKE A PERSON LIVE OR EVEN WISH TO LIVE WITHOUT LOVE.

The child must not only be loved, he must know that he is loved, have a sense of being loved, perceive himself as a person who is wanted.

The parents become well aware of the vulnerability of the child in respect to his deep need for a sense of being loved and wanted. Out of their own lack of understanding of the intense effect upon the child when such a need is jeopardized; out of their ignorance of the ultimate effect upon personality, they at times threaten the child with a withdrawal of their affection in order to force capitulation to their discipline and demands.

A parent can and should express disapproval of undesirable conduct, and should apply appropriate discipline for more serious infractions of the rules. But even through the most severe punishment the child should maintain the assurance of continuing love and affection. Certain behavior may be rejected but the *child* should never be rejected.

The need for a sense of personal worth. Most American children have an adequate sense of physical security, and also feel that they are loved and wanted. But when we consider how adequately their need for a sense of personal worth is met, we shall likely discover that as parents and as older members of the community we have fallen far short of giving them anything remotely approaching fulfillment.

Parents and other adults should be aware that the indignities which they constantly heap upon the head of the child are felt very keenly, and often with devastating results. Being summarily told to "shut up, or leave the room," or, "You're too young to know"; being constantly excluded from adult conservation and activity; being reminded of clumsiness and lack of skill and knowledge; being ridiculed—all these serve to remind the child of his ineffectualness and lack of maturity. Physical and mental subordination to the adult is apparent, but to be minimized as a person is as disheartening to the child as it is to the adult.

Some of this can be avoided if parents and other adults develop a genuine respect for the child as a person; listen to him attentively when he is speaking; avoid smiling or laughing at his efforts; dispel the superior-inferior atmosphere; include the child in some of the adult councils; and treat him as an *equal* member of the household. The parents should respect the child's right to disagree, to be annoyed with them at times, to express hostility and resentment, and to make choices.

The practice by many parents of comparing a child unfavorably with some other child is atrocious. "Why aren't you as smart as Johnny Williams?" or, "Your sister never gives me any trouble. You're about the worst kid I ever saw. Why can't you be sweet like she is?"

The rejection of a child's sex is another way of minimizing his worth. "Why did you have to be a girl? I wanted a boy."

But parents are also humans. The world is not, nor need it be, child-centered. Child-dominated parentage is a resentful and hostile parentage, regardless of how you try to conceal such attitudes, even from yourself.

The child should take his *symbiotic* place in the family and social schema—neither minimized nor maximized, but accepted and respected as a person of dignity and worth.

Probably childhood's greatest emotional stress is engendered by frustration of his need for a sense of personal worth. Here he fails to achieve fulfillment more than in any other need. Of course, we're speaking generally. There are individual exceptions, but they are rare.

Fantasy formation. If we have been unsuccessful in achieving this sense of adequacy, or personal worth and dignity, we sometimes take recourse to dreams and fantasy.

The day-dream as well as the sleep dream is often utilized at times to construct symbolically a situation wherein the dreamer experiences self-enhancement, worth, great achievement, and so on. This often takes the form of the conquering hero. One daydreams of himself returning home to receive the applause and acclaim from the populace for some great deed. He may visualize himself as taking charge of a sinking ship; of successfully saving all the women and children; or he may identify himself with certain characters in a story or in a motion picture, fantasying him-

self in the role of the hero. The fantasy may be in terms of academic achievement or scientific discovery, vocational success, wealth or fame. Continued, it may lead to delusions of grandeur—as the janitor who day-dreamed so intensely of playing Napoleon that he finally thought he actually was Napoleon.

The Need to Make Meaning out of Experience

It should be recognized by parents and other adults that the child is struggling with the cosmological problem—the nature of the world and the universe about him, and his place in it. They should stand ready to aid him clarify his own thinking and sharpen his perceptions.

This is the source of the child's incessant "why." It is intimately related to the exploratory drive. The new territory, the unfamiliar, must be known. Safety lies in knowing. A question, a query, an uncertainty leaves the individual without a framework into which he can fit experience. As the physical organism is motivated to develop behavior integrated with the environmental resources in an adaptive way, so it appears that consciousness, dealing as it does with symbols, is in a state of unrest until it succeeds in integrating its symbolic self with its symbolic environment. In common terms, *life must make sense.* Experience cannot remain inconsistent. It must be systematized.

System building will occupy a good bit of the time, and consume a great deal of the energy of the person. In terms of the economy of his available energy, the individual often accepts the ready-made systems that are presented him; religious systems, political systems, philosophical systems, social systems, economic systems, systems of personal values. These systems constitute external symbolic stimuli, and when they become internalized they provide directionality for decision and action; saving the individual the necessity in each and every confronting situation of weighing, valuing, judging, and discharging energy in an effort to determine the appropriateness of attitude and action. By utilizing a systematic frame of reference, individual effort is kept to a minimum. In face of the astronomical complexities and perplexities of living in present-day civilization, such a *shorthand of decision* is indispensable. Acceptance and action are determined by degree of consistency with the internally-established system.

The individual, however, does not always accept the ready-made systems—he sometimes builds his own; or, as happens more frequently, he modifies the ready-made systems in the light of his own experiences and frontal lobe activity.

Questioning by the child therefore should be encouraged, not discouraged. And his answers should be in accord with reality; not fairy tales and evasions. The curiosity that makes the scientist, the scholar, the artist and the inventor continues only if it is rewarded rather than smothered.

It is inevitable that the value systems commonly or widely held in the culture into which the child is born, and in which he is being reared, together with the attitudes and perspectives—the frames of reference—of the groups with which he will early identify himself (the primary groups) will furnish the primary directionality of the child's thinking as he structures his own system of meaning. These elements in his external symbolic environment cannot be avoided, evaded, or ignored. If he is being

reared in a Reformed Jewish home, he will likely subscribe to such a religious persuasion, rather than to Roman Catholic. If both his parents and most of his uncles are Democrats, he will likely vote the Democratic ticket. If his parents are very superstitious, he will be affected. If both graduated *magna cum laude* he will probably develop intellectual interests.

Fear stems from the sudden, the unknown and the unexpected. The exploratory drive is in the service of familiarizing the individual with his surroundings, and thus lessening the possibility of surprise and uncertainty. From the curiosity of a cat to the relentless probing of an Einstein, the need to know is in the service of reducing the uncertainties in life. The chief concern of the parent here should be to "get with" the child, to build confidence, and to keep the lines of communication open, in order that the child may feel safe in exploring with the parent his own thinking about himself.

Psychopathology

With this all-too-brief survey of the development of the child we are in a position to comprehend more fully the nature of pathology—organic and psychologic. Whenever the structural integration of the individual is assaulted, or his operational needs withheld, the adequacy with which he meets such threats to his physical or psychological integrity will spell the difference between health and pathology.

In this discussion we have emphasized the psychological aspects of the individual's structure, designating the four major psychological needs as:

1. The need for a sense of physical security.
2. The need for a sense of being loved.
3. The need for a sense of personal worth.
4. The need to make meaning out of experience.

It is normal and natural for the individual, when any of these needs is threatened, to become excited and to react with aggression or anxiety. This excitability is the protoplasmic and protopsychic basis for action—action which will lead to an attack on the problem, or a flight from the problem situation; the continued intactness of the individual being the aim.

When motivated to attack—to overcome the frustration, obstacle, or threat —the emotion experienced is annoyance, anger, hostility, rage, or hate; and the behavior is in terms of aggression and self-assertion.

When motivated to flee the situation, the emotion is worry, apprehension, fear, anxiety or panic; and the behavior is withdrawal or flight—actual or symbolic.

In most situations there is an alternation in the channeling of excitability between withdrawal and attack. We may at first feel an inclination to avoid the problem, or we may feel some apprehension. Then we become determined to do something about it. Then there may arise doubts as to the wisdom of positive action, and we again feel like withdrawing, only to marshal our resources once again for renewed attack.

Let us underscore that this is normal and healthy behavior; that is, it is normal and healthy if it does not exceed certain limits beyond which the behavior, positive or negative, becomes pathological. We might diagram it as in Figure I.

Examination of Figure I indicates ac-

tivity in both directions from the absolute mean—withdrawal reactions and aggressive reactions. But it also shows a range including both of these reactions which is healthy. It is when the anxiety and withdrawal reactions become extreme or excessive that they are regarded as pathological. Likewise, the assertive and aggressive reactions become pathological when they are overemphasized or overdetermined.

The insidious aspect of this is that these extreme reactions frequently give the illusion of safety, good adjustment and integration. The clinical evidence is that when they are continued as the characteristic response to the demands of one or more of these major psycho-

FIGURE I

RELATIONSHIP BETWEEN PSYCHOLOGICAL HEALTH & PSYCHOPATHOLOGY

WITHDRAWAL REACTIONS *Run, hide, give up, fear, anxiety, panic*		*AGGRESSIVE REACTIONS* *Fight, attack, hostility, anger, rage*
Range of *Pathological reactions*	*Mean* *Healthy activity range*	*Range of* *Pathological reactions*
1. THE NEED FOR A SENSE OF PHYSICAL AND ECONOMIC SECURITY		
Overwhelming feelings of timidity, inadequacy, insecurity, helplessness, Use of evasion devices. Retreat from a threatening world.	Efforts to become strong and self-reliant in coping with responsibilities of life. Attempts to establish economic security.	Physical aggression. Bullying. Security through exploitation and violence. Cut-throat competition. Health faddism. Compulsive go-getter. Hypertension.
2. THE NEED FOR A SENSE OF BEING LOVED AND ACCEPTED		
Social timidity or indifference. Introversion. Monasticism. Obsequiosness. Fawning. Hypocrisy. Psychopathic personality. Social insensitivity. Feelings of rejection.	Efforts to establish congenial and rewarding interpersonal relationships. Search for love and acceptance.	Neurotic demands for love. Irrational striving for acceptance. Aggressive conviviality. Compulsive extraversion. Sexual scalp-collection. Possessiveness.
3. THE NEED FOR A SENSE OF PERSONAL WORTH		
Feelings of worthlessness, guilt, shame, inferiority. Self-devaluation, self hate. Self-rejection, self contempt. Intimidated ego. Feelings of failure and defeat.	Attempt to know, improve, and utilize personal resources; to express oneself creatively; and to establish self-respect and dignity.	Excessive demand to be admired and approved. Conceit. Boasting. Grandstanding. Superiority-complex. Ego-mania. Vain Obsessive self-aggrandizement.
4. THE NEED TO MAKE MEANING OUT OF EXPERIENCE		
Paralyzed curiosity. Intellectual apathy. Flight into neurotic and psychotic fantasy. Aimlessness. Pessimism. Sense of meaninglessness.	Active curiosity. Attempts at perceptual accuracy; to distinguish between fake, fantasy and reality; to establish life-goals and cosmic-personal harmony.	Obsessive curiosity. Aggressive ideology. Fanaticism. Jehovah complex. Demand for absolutes. Idealistic rigidity. Utopianism

logical needs, the ultimate end is disorganization and disaster.

Here in this figure we have schematically summarized the relationships between healthy and pathological reactions. We feel that this might aid in clarifying some of the confusions which have characterized these matters in the past.

For example, there has been a great deal of emphasis on courage, determination, striving, and self-assertion. Actually, it is frequently politic and strategic to withdraw; as in the case of a young man with an IQ of ninety-five who courageously strives to become a dentist, a physician, or a Ph.D. in psychology. To continue his struggle is but to multiply disaster. Likewise, it is often healthy to have a bit of anxiety, concern, and even fear; because without these the effort might never be made to correct an unhealthy and unrewarding life situation.

It is when fear and anxiety become overwhelming; when they paralyze initiative; when one stands before practically every problem feeling inadequate and helpless; when one brings to the simplest situation anxiety-laden apprehensions, forebodings of failure and catastrophe; in other words, when one is generally intimidated by life, that one is psychologically ill.

It was these negative reactions which so impressed Freud, and which have impressed most of those who have followed after him in the work of psychotherapy and clinical psychology. Over and over again theories of psychopathology and techniques of psychotherapy are centered around the concept of the *intimidated ego.*

Recently, one author in this field has stressed the pathological aspects of over-assertiveness.*

Whereas the past emphasis has been on fear, this author's emphasis is on the pathologic aggressive reaction—the attempt to assert oneself. This emphasis is overdue. But to underscore either withdrawal or assertion to the exclusion of the other is to present an incomplete picture of psychopathology; and is to neglect the problem of setting limits to the extent to which the patient should move in the opposite direction.

The cure for the intimidated, negative, anxiety-laden person is not unlimited movement in the direction of courageous self-assertion, but is some where this side of excessive aggression. The cure for the pathologically aggressive individual is not the strong and continued application of brakes, or inhibitions, to his conduct, because the overinhibited, paralyzed personality is also sick.

The healthy personality walks somewhere in between these two extremes, exhibiting at times a sufficient degree of concern or anxiety to motivate him to action; and enough self-assertion and aggressive action to insure the satisfaction of his basic physical and psychological needs.

Although what we have said here applies to all of us throughout the entire span of our lives, it has a special pertinence to childhood, because it is in childhood that the characteristic patterns of responding to life are laid down. As adult guides, tutors, and identification-models for the child we should understand his extreme behavior as an effort to satisfy his needs, or to avoid the pain of unfulfillment. We should be

* Phillips, E. Lakin. Psychotherapy. Prentice-Hall, 1956.

prepared to aid him in his search for techniques within the *healthy activity range* which will be minimally traumatic and maximally rewarding. As our first psychologist, Aristotle, put it twenty-five hundred years ago, the pathway of health and well-being is The Golden Mean.

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Pulp Amputation and Healing*

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EDITOR'S NOTE: *The accompanying review should provide a comprehensive source of material for those of us who wish to consider the many facets of pulp therapy. Although the references are numerous, the continuity of the subject matter is maintained nicely, so that reading is easy. Try it!*

Dennis Berman has returned to London, England and is teaching at the London Dental Hospital. He is completing an addition to his home which will provide him with adequate facilities for the exclusive practice of dentistry for children. We wish him well.

A.E.S.

INTRODUCTION

The problem of maintaining the vitality of the dental pulp exposed by caries (or by accident) has engaged the attention of the dental profession for two hundred years.

In view of the current interest in pulp amputations and in the problem of pulp healing, it was felt that a review of the literature and the history of pulp amputation would be of interest to the dental practitioner and the investigator dealing with this problem. Although an excellent review of the literature and the history of vital pulp therapy was prepared by Castagnola (1953), it was written in German. A comparable review is not available in the English language. It was therefore decided to review the literature, in extenso, to provide future investigators with an additional source for this information. Not infrequently one discovers that "new" techniques or findings are not new at all, but have been suggested and used during an earlier era.

Hoffman (1937) divided the development of vital pulp amputations into three eras. She referred to the period before 1874 as the "Empirical Era." From 1874 to 1921 was called the "Antiseptic Era." From 1921 until her time of writing (1937) was referred to as the "Aseptic Era." We would like to think of the present as the "Experimental or Biological Era."

THE EMPIRICAL ERA

This period in the history of treatment of the exposed pulp is aptly named. Experimental science was still very new and dental practitioners were searching on a trial or error basis for a panacea to cure the injured pulp. Each would acclaim his own to be the best method of treatment. Unfortunately, while much was said and written concerning the virtues of various techniques and medicaments, very little was actually proved. The experimental approach and statistical analysis were almost unknown.

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In 1756, Philip Pfaff (cited by Castagnola, 1953) attempted to cap exposed pulps with a small piece of gold foil carefully fitted to the cavity. Between 1750 and 1850, very little attention was paid to pulp capping and only occasional reports appear in the literature. Castagnola (1953) in a historical review of pulp capping refers to L. Koeker who in 1826 cauterized the exposed pulp with a hot iron wire and then placed silver or lead caps over the exposures. Castagnola also quotes Albrecht (1856) who used opiates, caustics and eugenol on the exposed pulp. M'Kown (1859) recommended cotton soaked in creosote and tannic acid, whilst Taft (1859) was in favour of cauterizing recently exposed pulps with nitric acid and placing a filling immediately. None of these authors attempted to evaluate their results on any absolute or comparative basis since this was not the custom at the time. Only personal, subjective evaluations were offered.

Prominent amongst the American school was W. H. Atkinson (1866-1868) who wrote strongly in favour of conserving the pulp even before filling. He suggested amputation of all projecting cornua of exposed pulps and placement of a temporary filling until it was healthy. Only then would he fill the tooth permanently. Atkinson firmly believed that the habit of saturating every cavity with creosote before filling would do more to preserve the vitality of the exposed pulp than any other single method of procedure. The history of vital pulpotomy and pulp preservation therefore really begins in early 1860. Witzel (1881) writes that the method of Atkinson was adopted by German dentists and was known in Europe as the "Great American Invention" or "Atkinson's Method." It should be noted that failure of the pulp to remain vital did not necessarily mean loss of the tooth, since there was still left the method of pulp extirpation and root canal filling as a further method of treatment.

In 1899, Biro of Hungary published a critical review of the conservative treatment of the tooth pulp. He indicated that soon after Spooner discovered the destructive action of arsenic upon the pulp, all diseased pulps were treated with arsenic and then covered. This was believed to be the perfect solution to the problem. Later, however, it was discovered that pulps treated with arsenic not only died, but also decomposed. Biro pointed out that Baume in 1888 was the first to recognize that such a tooth could only be preserved on a more permanent basis if the devitalized pulp were extirpated. Thus was the present method of pulp extirpation developed.

However, there soon arose a demand for the preservation, not of a tooth alone, but of a tooth with a living pulp. In America, many mixta compositae were fabricated in an attempt to aid the exposed pulp to heal. No serious effort was made to differentiate pulp diseases. Consequently results were generally unpredictable and often unfavourable with the result that such conservative methods fell into disrepute. Treating the pulp with carbolic acid and then covering with oxychloride cement was often advocated to preserve the pulp. It is now recognized that oxychloride cement is highly acid and injurious to the pulp even when placed in shallow cavities at a distance from the pulp. The procedure was modified by King in 1873 who used zinc oxide mixed with 2 per cent carbolic acid in creosote. He covered this paste with zinc oxychloride cement. King

(1881-1886) wrote "For capping to be made an *invariable* success must ever remain an impossibility." Harker (1892) said "I believe I practice conservative treatment of teeth by non-conservative (i.e. destructive) treatment of diseased pulps." A third writer, Ailen (1866) pointed out that a pulp could not be fully cured because it is enclosed in a hard, unyielding mass of dentin. This fallacious statement is still repeated today.

Although empiricism was the common practice at this time, it should not be concluded that the men of this era were incapable of scientific thought or keen observation. Considering the facilities available to them, some made remarkable achievements. Such a man was Louis Jack (1873). He maintained that the preservation of the vitality of the pulp was possible, and especially favourable, in those cases where a new formation of secondary dentin within the pulp sealed off the exposure. He stressed that treatment should be directed to bring about the formation of secondary dentin. The desirability of retaining the vitality of the pulp was too manifest to require argument. Jack (1873) asked the following question: "Is an organ impatient to treatment and incapable of obeying the laws, which, everywhere else in the animal economy do not fail to assert their power to secure the ends of self preservation and repair?"

It is evident that although trial and error was the order of the day, men such as Jack (1873) and Atkinson (1868) were thinking in terms of preserving the vitality of the pulp. Many different materials were used to cover the pulp and disagreement prevailed as to their efficacy without any real attempts to assess their virtues or deficiencies on an objective scientific basis since the latter were not yet available.

F. A. Hunter (1883) went so far as to present the following formula for pulp capping:

Rx
Sorgum molassum—one pint
Droppings of the
English Sparrow—one pound
M. et ft. Mistura
Sig: For pulp capping

Furthermore, he claimed 98 per cent success (!) and was loudly applauded at the meeting of the Missouri State Dental Association in 1883.

However, there were other, more rational suggestions. Perhaps the most intelligent was that of J. F. Foote (1866) who said that the best covering for the amputated pulp was a blood clot.

The Antiseptic Era

The use of antiseptics to destroy bacteria and thus to aid the injured pulp to recover followed (naturally!) Lister's demonstration of antisepsis in general surgery. This did not mean that the bacteriologically (and biologically) unsound methods already in use were discarded. In fact some practitioners still use methods advocated before 1860.

Witzel (1874) introduced the deliberate amputation of the infected portion of the pulp as a therapeutic measure. He believed that the entire coronal portion of the pulp should be removed and the remaining radicular stumps covered with antiseptics. He preferred weak phenol solutions to destroy bacteria and prevent decomposition. He maintained that these pulps healed by the formation of scar tissues. He believed that if the vitality of the pulp were maintained, a building of secondary dentin would occur, a conclusion which is still valid, today.

Later, in 1886, Witzel (cited by Miller, 1899) used sublimate cements. He believed that the pulp was caused to change into aseptic threads by these medicaments. He originally reported only 3 per cent failures in a large number of cases treated. Follow-up review of his cases however, revealed many additional failures, probably due to the strong antiseptics used. He then changed his original thesis and believed that complete healing of the pulp was impossible. The major contribution made by Witzel was the fact that he tried to apply the teaching of Lister to the problem of the infected pulp. Biro (1899) pointed out that Witzel did stress that "The essence of antiseptic treatment rests upon the principle of cleanliness" a principle which is the keynote of successful wound healing today.

Miller (1899) reported that Baume in 1888 used alum or borax to saturate the remains of the pulp following amputation. He initially reported 300 successful cases but later admitted many failures.

The use of formaldehyde for the disinfection of infected and inflamed pulps was first reported by Lepkowski (1897). He used a 40 per cent solution of formaldehyde in water. This was placed over the exposed pulp but caused intolerable pain. However, of 4,679 cases so treated only 43 cases were regarded as failures.

Controversy raged over the whole problem of pulp therapy. Miller (1893) believed Witzel's work to be a step in the right direction. He claimed that the object of treatment should be to prevent decomposition of the pulp by complete sterilization of its contents. He believes in impregnation and destruction of the pulp with suitable antiseptics, rather than to retain its vitality. Gysi (1899), the brilliant Swiss investigator, tested the efficiency of many antiseptics and suggested the use of a "mummification paste" or triopaste containing arsenic, paraformaldehyde and creosol. Although the tooth was retained by this method, the pulp was completely devitalized. Boennecker (1899) as reported by Prinz (1899) also used formaldehyde and arsenic.

Arkoevy (1899) discussed, in an excellent paper for that time, the fundamental principles for the conservative treatment of dental pulps. He raised the following question: "Why have the same principles of anatomy, pathology and other sciences which are applied to the body not been applied to the pulp?" The projection of this thought is exemplified by the following quotations: "The results of the operation in pulp capping was the recognition that ebur secundaris is able to be developed as a result of operative treatment. The ebur secundaris is according to its nature, a kind of dentin callus, which means that a wound in the dentin goes through a similar process of healing to that of bone. Through these experiences, the first foundation of a healing process for pulp chamber, and the curative process of the pulp were itself laid." Arkoevy (1899) brought to notice two other points, which may still be considered controversial or unsolved:

a) Although odontoblasts are necessary for the production of ebur secundaris there can be formation of (atypical) dentin independent of the stratum of odontoblasts—but there must be sufficient embryonic cells in the body of the pulp.

b) The vitality of the pulp is not dependent on the formation of a callus.

Tomes (1896) of England described

in detail the histological structure of a tooth that had healed by forming a calcific bridge under a large pulp exposure. He observed many dentin splinters within the new calcific bridge. Tomes (1896) believed that treatment should be aimed to stimulate the formation of secondary dentin, so that an exposure may be recovered. Therefore it was improper to use any medicament that was too strong or caustic lest this destroy the formative cells and thus interfere with the healing processes. He felt it was rational not to remove the clot of blood forming over the amputated pulp stump but to protect it with an indifferent cap such as sterilized fibrin or gelatine. With these astute observations, Tomes laid the foundation of the histophysiology of pulpal healing 60 years ago. Very little has been added since.

Biro, a pupil of Arkoevy, in 1899 also ably reviewed the conservative treatment of exposed pulps up to the turn of the century. According to Biro (1899), Miller felt that it was not wise to attempt the conservation of the pulp by capping, unless it were first put into a perfectly aseptic condition. Miller was in agreement with Tomes in advising against the treatment of inflamed pulps. "The pulp being enclosed in the firm walls of the tooth, the absence of lymph vessels and the impossibility of thorough drainage, placed difficulties in the way of the therapeutics of pulpitis."

In spite of this, Miller did not believe that every pulp should be devitalized, "That is going too far, for I believe that there are certain cases in which inflammation can be reduced and a cure attained." This had been indicated earlier by Walkhoff in 1883, who did not believe that an inflamed pulp was a lost organ. He carefully distinguished between the degrees of pulpal inflammation and planned his treatment accordingly. At this time he introduced Iodoformknopel, made by mixing a powder consisting of "ivory" and iodoform (each 50 per cent) with carbolic acid or chlorophenol, to form a paste. This was applied to the amputated stump in manner similar to that suggested by Witzel (1874).

Boedecker (1892) advocated the Herbst method of treating pulp. This necessitated devitalizing the pulp with cobalt and removing the unhealthy superficial tissue. The pulp stump was then washed with a solution of corrosive sublimate and tin foil was placed directly over the amputated pulp stump. Histologically, some of the treated canals were seen to contain globular deposits of lime salts.

The majority of people recommended capping in cases of traumatic exposure, but opinions varied as to the method to be used (Biro, 1899). Dentists were becoming aware that failures after treatment might be due to incorrect diagnosis of the state of the pulp before treatment, as indicated by Boedecker (1882), Biro (1899), Lipshitz (1912) and Mummery (1914). Accurate assessment of the true state of the pulp is not completely possible even today, yet successful therapy may well depend on this criterion.

In 1902, Szabo (quoted by Castagnola, 1953) reported good results in one hundred cases using zinc oxide after applying a heat cautery. Another technique used by Hentze in 1907 was to apply a mixture of zinc oxide, zinc sulphate, mastic and eugenol, to promote a protective layer of secondary dentin.

Percy Howe in 1919 stressed the abil-

ity of the pulp to repair itself and overcome a reasonable amount of infection. He used zinc oxide and eugenol, silver nitrate and eugenol, and capped others with eugenol alone. He gave no indication as to the percentage of success following such treatment.

Gradually, scientific investigations were initiated to determine the results obtained with the various medicaments. In the European School, mummification of the pulp followed by amputation or total extirpation were the predominant methods of treatment. This procedure evolved directly from Witzel who was described by Hellner (1936) as the (1936) as the "Grand Old Man" of *rational* root canal therapy. This procedure was given added impetus by Gysi, who had many followers. Castagnola and Orlay (1951) described this method of pulp amputation, in which the pulp was first devitalized, as "mortal amputation." The earlier histologic investigations in Europe concerned themselves with the reaction of the pulpal and periapical tissues following mortal amputation. These findings have been reviewed by Bonsack (1929) and by Hess (1929) and more recently by O. Mueller (1953). The reader is referred to these publications for a review of the effects of devitalization procedures on the periapical tissues.

The Aseptic Era

It was about this time that scientific investigation into pulp therapy began to supersede empirical or "logical" procedures.

Davis (1920-21) in the U.S.A. advocated vital pulpotomy and partial root canal filling. He pointed out that complete pulpectomy was seldom achieved since the majority of teeth had multiple foramina. Davis suggested that the bulbous or coronal portion of the pulp should be amputated at any point between the floor of the pulp chamber and the dentino-cemental junction in the pulp canal. The operation was carried out under local infiltration or pressure anaesthesia. Teeth so treated had partial or complete closure of the root canal by an osteoid tissue. Davis emphasised that caustic or injurious antiseptics should not be used. It was preferable, he insisted, to use asepsis and mild medicaments such as phenolised-eugenol which did not destroy the healing capacities of the tissues. Davis reached the following conclusions:

a) *If the pulp is correctly amputated it will, in the absence of gross infection and destructive drugs, remain vital and undergo a tissue metaplasia which will sometimes completely obliterate the pulp.*

b) *It is necessary to leave the apical portion of the vital pulp in situ if closure of the canal and multiple foramina is to be expected.*

This was a courageous paper, published at a time when pulpal mummification and total extirpation was considered the best practice. In fact, this paper is still well ahead of its time. One of the contraindications for complete pulp extirpation and root canal filling is the presence of very narrow and tortuous canals with multiple apical foramina. It is almost impossible to seal such canals satisfactorily with gutta-percha. Partial pulpectomy, especially in molars, would save thousands of teeth now doomed to extraction.

In the same year (1921) Daetwyler experimented with the methods advocated by Hentze and by Szabo, and also

investigated the possibilities of capping pulps with Walkhoff's paste (50 per cent iodoform and 50 per cent alcoholised chlorphenol) or with paraffin-thymol. Daetwyler found Szabo's method (heat cautery and zinc oxide) most useful for capping hyperaemic pulps. Hentze's method using zinc oxide and eugenol was the next most successful and Walkhoff's chlorphenol paste the least favourable. His results are very interesting in view of the recent revival in the use of monochlorphenol in endodontics. Of 119 teeth treated by various methods he was able to follow 110 teeth for 6 to 9 months. Of these, 16 were examined histologically. He observed an apparent stimulation of the pulpal tissue to form secondary dentin where dentin splinters had been pushed into the pulp during the operation. Daetwyler felt that the pulp had a relatively strong resistance against infection.

Rebel (1922) held the opposite viewpoint to Davis and Daetwyler. He performed cappings on the teeth of cats and dogs. Rubber dam and sterile conditions were used. Medicaments (iodoform, thymol, or trio-paste) were applied to the pulp tissue followed by gold foil, and finally covered with gutta percha or dental cement. In some specimens the pulp was left open. All the pulps died. Rebel therefore concluded that although in a few rare cases one may get a new calcific covering to an exposure, "it is impossible to get recovery of the pulp and one must consider an exposed pulp a lost organ." It is entirely possible that Rebel's failure to preserve the vitality of the pulp was due to marginal leakage characteristic of the filling materials in use at that time.

Hoffman (1937) wrote that the influence of Rebel was so strong that his statement inhibited further efforts to use vital pulpotomy techniques and increased the trend to total pulpectomy techniques, especially in Europe.

Palazzi of Italy in 1927, confirmed the conclusion of Rebel. He amputated the pulps of teeth in young healthy dogs, under aseptic conditions. Palazzi covered the exposure with asbestos or silver caps and finally sealed the treatment with zinc oxyphosphate cement. All the pulps underwent varying degrees of degeneration. There was no evidence of pulpal healing. Palazzi (1927) concluded that "an injured pulp was a dead pulp." Here again one is tempted to speculate whether the cause of these failures was due to the failure in sealing the pulp against salivary contamination—especially in view of the successes reported by other investigators.

In spite of the conclusion made by Rebel and Palazzi, Hermann (1930), Hellner (1930-33), Hess (1950) and others persisted in their experiments. They used mild medicaments over vital exposed pulps, sealed in the medicament with care—and reported high percentages of success. In a few instances, surgical amputations were also performed on healthy teeth to eliminate the infection and inflammation introduced by the caries. The drugs used included zinc oxide and eugenol, powdered ivory, calcium salts and others. The results obtained by the use of these substances will now be discussed.

Zinc Oxide and Eugenol

Attempts to promote healing of the pulp by covering with a paste of zinc oxide and eugenol had been suggested shortly after the turn of the century by Szabo (1902), Hentze (1907) and Daetwyler (1921). Each claimed resonably

good success following the use of zinc oxide and eugenol paste over carious exposures and over amputated pulp stumps. Leonard (1924) reported on the use of zinc oxide and eugenol paste with aristol (thymol iodide) added, over the amputated stump of human teeth. After 20 years of study and 1,000 cases, he claimed only 1 per cent (!) failures. He reported that the resorption of the roots of primary teeth so treated was normal.

Castagnola (1953) cites Shumacher (1930) of Basel who reported on the effect of eugenol on the pulp. He placed eugenol directly on the pulp stumps of two teeth and observed, in histologic sections, great destruction of the pulpal tissue and the formation of hard tissues could not be seen. Chaneles (1933) capped pulps with zinc oxide and eugenol and claimed good results both clinically and histologically. Aiguier (1933) recommended the use of a mixture of 2 parts zinc oxide and 1 part thymol, applied to the pulp under a metal cap. Roy (1936) used a paste of 3 parts zinc oxide and 1 part aristol mixed with eugenol. He claimed good results clinically.

In 1941, Kenneth, et al., treated exposed young pulps by covering the exposure with a paste of silver powder, zinc oxide, thymol iodide, rosins, glycerine and crystallized iodine. They found, in 10 teeth examined radiographically one year later, that there had been the formation of a hard substance making the pulp canals smaller. Dillion (1941) experimented with a variety of medicaments containing eugenol. He found that by comparison, calcium hydroxide gave the best results. Jamesson (1948) used a paste containing thymol, chlorobutenol, clove oil, barium sulphate, zinc oxide and asbestos powder. He claimed 95 per cent success in 1,000 cases treated over a period of 12 years.

Rosenstein (1949) published the result of a clinical study on capping the pulps of primary teeth and first permanent molars. The exposed pulp was first cauterised with a 95 per cent phenol solution, and then dried with warm air. Finally, the exposure was covered with one of the materials shown in the table. The percentage success claimed for each of the medicaments was as follows:

A) Copper cement	92.3%
B) Copper cement plus silver nitrate	91.4%
C) Zinc cement and silver nitrate	92.5%
D) Zinc oxide and thymol	85.7%
E) Zinc oxide and eugenol	85.0%

Of 512 primary teeth treated, 90.4 per cent were successful. The author came to the conclusion that the diagnosis and careful treatment of the exposed pulp were more decisive factors than the medicament used in capping.

Murphy and Salviolo (1949) reported successful treatment of injured pulps in 2,000 teeth. They used a powder of zinc oxide, calcium hydroxide, rosin, thymol iodide; and a liquid containing phenol and eugenol. Gardner (1950) reported success using a paste of zinc oxide powder and a solution of calcium hydroxide.

Up to this time, most of the reports on the use of zinc oxide and eugenol were based on clinical or radiographic evidence. In 1949, Glass and Zander initiated what may be called the Biological Era in pulpotomy studies. From this time on, more attention was given to the histologic analysis of the healing process and to the biology of the injured pulp. Laboratory animals began to be used more frequently in order to obtain controlled conditions for study and analysis. Glass and Zander (1949) conducted a well planned histological study into

the effects of calcium hydroxide and zinc oxide and eugenol on young healthy aseptically exposed human pulps. The teeth were extracted at intervals of 24 hours to 8 weeks. At the end of four weeks, the pulps under calcium hydroxide had formed a well defined layer of new dentin with a subjacent layer of new odontoblasts. Thus the pulp was judged to be healed. Pulps covered with zinc oxide and eugenol had not yet formed any secondary dentin. Under zinc oxide eugenol, the exposure was walled off by chronic inflammatory cells. In a second study, Zander and Glass (1949) studied the effects of phenol applied to the pulp before capping healthy young pulps with calcium hydroxide and with zinc oxide and eugenol. They observed that calcium hydroxide alone produced a necrosis of the superficial portion of the pulp tissue to which it was applied. Zinc oxide and eugenol did not have this effect. The application of phenol also caused the formation of a necrotic zone. They wished to determine whether the application of phenol reduced or enhanced the action of the medicament in promoting pulpal healing. The zinc oxide and eugenol specimens formed granulation tissue under the phenolized pulp stump but did not form a dentin bridge. The application of phenol did not appear to significantly alter the healing process under calcium hydroxide. Zander and Glass (1949) concluded that the alkaline pH was an important factor in promoting pulpal healing although the production of a necrotic layer also appeared to be necessary.

Castagnola (1953) reported on eight teeth whose pulps had been capped with zinc oxide and eugenol paste and two which had been vitally amputated and then covered with the same material. He found little or no newly formed hard substance. Four of the capped teeth were inflamed. The amputated teeth were regarded as complete failure since they were extracted owing to severe pain. Castagnola (1953) did not recommend the use of zinc oxide and eugenol in pulp therapy. He maintained that those successes claimed by other workers on a clinical or radiographic basis, needed to be verified histopathologically. Nevertheless Castagnola (1953) did show two specimens in which bridging had occurred following the use of zinc oxide and eugenol. He maintained this was due to the dentin spicules that had penetrated into the pulp tissue and was not due to the medicament.

Massler, Perreault and Schour (1955) used the amputated pulp of the incisor of the rat to test the effects of various medicaments on pulpal wound healing. In a preliminary study, they indicated no marked differences in the pattern of healing under various calcium salts and zinc oxide and eugenol. In a much more extensive series, O'Malley (1956) studied the effects of different calcium salts, sterilized bone powder, zinc oxide and eugenol and gelatin sponge on healing of pulps in rat incisors following partial amputation. He found that direct injury alone, the gelatin sponge and the various calcium salts caused similar changes. He observed a zone of necrosis adjacent to the injury. The subadjacent zone showed acute inflammation and scar tissue and the formation of osteoid tissue. Zinc oxide and eugenol produced moderate inflammation and an hyperplastic response.

In 1956, Cooke and Rowbotham reported the result of treating the exposed pulps of 175 fractured incisors with zinc oxide and eugenol. Success was based on

clinical tests and radiographic evidence. The minimum time any tooth was under observation was one year. At least 52 cases were observed for three years or longer. It was found that of 175 pulpotomies performed, with zinc oxide and eugenol being the capping material, the percentage of success was 81 per cent. They found, too, that the highest percentage of success occurred when teeth with open apices where treated within 48 hours of the traumatic fracture. As the delay in treatment increased so the chance of success diminished. Whatever the period of delay, the prognosis was invariably better when the apex was open than when it was closed.

Miyamoto (1957) successfully performed vital amputation on the pulps of rat molars. In these teeth, he found no marked difference histologically in the pattern of pulpal healing under zinc oxide and eugenol paste, paraffin wax and different calcium salts. Bridging by secondary dentin was seen under all medicaments after three to four weeks. Minor differences in the reaction of the pulp to the different medicaments could be observed, but the basic pattern of healing appeared to be the same under all the medicaments used. Miyamoto's technique should make it possible to study the finer details of pulpal healing under controlled conditions in this experimental animal.

Powdered Dentin

The ability of dentin splinters accidently pushed into the pulp to stimulate the rapid formation of new secondary dentin had been observed by Daetwyler (1921) incidental to his major study. This action has been confirmed many times since. Miyamoto (1957) also observed the presence of autogenous dentin splinters in the pulp tissue of rat molars, following surgical amputation of the superficial portion of the pulp. Wher ever the splinters were pushed deeper into the pulp tissue they appeared to stimulate secondary dentin formation. Where present in the superficial portion of the remaining pulp the dentin splinters seemed to stimulate a necrobiotic reaction.

The ability of dentin splinters to stimulate the formation of secondary dentin naturally suggested the use of powdered sterile dentin to promote pulpal healing under exposures and amputations. During the early thirties, Neuwirth (1933), Hellner (1930), and Feldman (1934) experimented with the use of powdered dentin to cover the wounded pulp. There appears to be some controversy as to who was actually the first to experiment with this material. Hellner (1930) used triopaste in addition to the dentin splinters over pulp exposures and amputations. He had many failures and therefore rejected the use of any antiseptics. He was in favour of an aseptic and biologic approach. Neuwirth (1933) and Feldman (1934) felt that the dentin splinters acted as a catalyst to promote healing of the pulp.

Castagnola (1953) described the method of obtaining the powered dentin to be used as follows:

1) Dentin taken from the same tooth of the pulp to be treated (auto-implantation).

2) Dentin taken from another tooth of the same patient (auto-transplantation).

3) Dentin removed from a tooth of another person usually after extraction.

4) Dentin from the teeth of animals.

Hellner (1933) capped thirty teeth with dentin implantations and reported

the clinical and radiographic findings in twenty teeth. Two teeth remained symptomless and were radiographically negative. Four were extracted due to pain. Four teeth were considered to be clinically and radiographically sound, and the remaining ten were successful in every respect. This showed a 50 per cent success. Hellner felt that four of the cases failed due to poor technique. He recommended dentin implantation especially for teeth with incompletely formed roots. The integrity and vitality of the pulp tissue were maintained under dentin splinters and it was possible for a new hard tissue substance to form and close off an exposure.

In 1935, Willner carried out pulpal amputations is one hundred and thirty-six human teeth and five dog's teeth. Sixty per cent were clinically normal, 20 per cent hyperaemic and the remainder had a partial pulpitis. The amputated stumps were covered with the medicaments listed below. The failure as determined clinically and radiographically are also shown.

104 teeth covered with "Pulpatekt" ..... 12% failures
12 teeth covered with dentin splinters .... no failures
25 teeth covered with "Walkhoff's paste" ..... 8% failures

Histologically, he observed the formation of a necrobiotic area before true dentin formation commenced. Active and passive calcification did occur in the majority of cases but the calcific barrier only in the absence of infection. Of the teeth examined histologically the number found to be infected were:

49 teeth treated with "Pulpatekt" ..... 70% infected
11 teeth treated with dentin splinters .... 50% infected
22 teeth treated with "Walkhoff's Paste" .. .. 40% infected

Because of the large number of infected cases, Willner (1935) concluded that vital amputation of the pulp should NOT be taught as a method of root canal therapy.

Hoffman (1937) capped forty-seven clinically healthy teeth with autogenous dentin splinters and alien, sterilized dentin powder. Two to three weeks later, there were no adverse symptoms. After three to nine months, thirty-four teeth were extracted and prepared for histological examination. Hoffman's findings are indicated below.

20 teeth ..... showed complete bridging by newly differentiated odontoblasts. There were no indications of inflammation.
5 teeth ..... had round cell infiltration and calcifications present in the pulp. Even so, there was formation of secondary dentin and complete closure of the perforation.
6 teeth ..... showed infection to be present with inflammation, but localized to the pulp chamber by a connective tissue abscess membrane.
3 teeth ..... bridging was not complete but the perforation was narrowed. Secondary dentin continued to form on the sides of the chamber and canals. The pulp was essentially normal.

Hoffman claimed 82 per cent success. She noticed the presence of a necrobiotic calcific layer before secondary dentin formation.

The disparity of the results obtained by Willner (1935) and by Hoffman (1937) (although the work was carried out in the same laboratory) might be explained by the fact that Hoffman used zinc oxide and eugenol paste to seal the

cavities in the teeth, whereas Willner used an oxyphosphate cement. Grossman (1939) and Massler and Ostrovsky (1954) have shown that zinc oxide and eugenol is an effective sealing agent with little or no marginal leakage while oxyphosphate cement shows marginal leakage within 24 hours after setting.

Powdered Ivory. O. Mueller (1938) recommended powdered and sterilized ivory (dentin) from the tusk of an elephant. O. Mueller (1938), F. Martin (1940) (cited by Castagnola, 1953), Zeltner (1938) and H. Mueller (1938) all of the Basle School in Switzerland tested the effects of this material on the pulp clinically, radiographically and histopathologically. All of these authors agreed in the main with the findings of O. Mueller (1938). The powdered ivory was surrounded by a dentin-like substance which formed a barrier over the amputated pulp and made contact with the normal dentin on the side of the tooth. They claimed 50-55 per cent success. Mueller believed that the dentin fragments caused a reactivation of the odontoblasts already present, as well as the differentiation of new odontoblasts from the pulp tissue. He believed, further, that these odontoblasts may send processes into the canals of the ivory, thereby inducing the transformation of the elephant's ivory into human dentin. The underlying pulp was normal.

E. Studer (1941) examined the effects of powdered ivory by capping the exposed pulps of sixty-one teeth. In healthy teeth, with no pathology, 53 per cent were successful. The results over inflamed pulps were very poor. Thirty-nine teeth were examined histologically. Sixteen showed a successful result. On the basis of Studer's results, Castagnola (1953) concluded that powdered ivory cannot be recommended for pulp capping, especially when the pulp is inflamed.

Castagnola (1953), on the basis of the previous authors and his own work, rejected the use of powdered dentin over vital amputation of the pulp. He recommended it for the direct capping of accidentally exposed pulps where sufficient autogenous dentin could be obtained from an adjacent non-carious area.

In 1956 James and Englander performed pulpotomies on thirty unselected human teeth. Defatted bone powder was placed in 14 and sterile defatted dentin powder in 16. The survival time was from 18 days to 181 days. Calcific bridging was absent in all cases. Internal resorptions were observed in 55 per cent of the specimens.

Inert Materials

Materials which are physiologically inert have also been used to cover the exposed pulp. These include such substances as asbestos fibres, charcoal, silver plates, silver foil, gold foil, paraffin and gelatin sponge.

In 1927, Palazzi used asbestos and silver caps to cover exposed pulps. All the pulps died. More recently Kreshover and Bevelander (1948) treated exposures in dog's teeth by covering with tin foil. They observed that inflammatory changes occurred with abscess formation and necrosis. On the other hand, calcific deposits were seen around dentin splinters introduced into the pulp during the operation. Nyborg (1955) used silver plates and charcoal to cap experimentally exposed pulps of human and dog's teeth. His findings were similar in both cases; moderate to marked cellular infiltration. Many specimens showed in-

cipient suppurative disintegration or the presence of granulation tissue with no abscess formation. The possibility of healing was considered unfavourable. None of the above reports indicated the presence of calcific bridging.

O'Malley (1956) used absorbable gelatin sponge, along with other dressings to cap experimental exposures in rat incisors. He found it evoked the same stereotyped response as seen under calcium salts.

Miyamoto (1957) whilst using paraffin to cap amputated pulps of rat molars, demonstrated dentin bridging and the same process of healing as when using calcium salts or zinc oxide and eugenol paste.

Thus a distinct difference of opinion exists as to the effects of inert materials on the exposed pulp. Pallazzi (1927), Kreshover and Bevelander (1948) and Nyborg (1955) consider the effects to be detrimental to the pulp while O'Malley (1956) and Miyamoto (1957) observed no differences between inert and "medicated" materials.

Calcium Hydroxide

Since the beginning of the Aseptic Era the medicament most widely used as a dressing over the exposed pulp has been calcium hydroxide. Castagnola (1953) cites Hermann (1920) who in a dissertation at Wurburg recommended a preparation containing calcium hydroxide for promoting the healing of the exposed pulp. In the United States, Zander and Teuscher (1938) were the first to suggest the use of calcium hydroxide over exposed pulp and Zander has since supported its use by numerous clinical and histologic studies. Since that time a variety of compounds containing calcium hydroxide have been recommended for pulp capping and as a dressing over amputated pulps. These medicaments have been outlined by Castagnola (1953) and are recorded below.

Calxyl. Manufactured in Frankfurt-on-the-Main. It contains a base of $Ca(OH)_2$ to which is added NCl, $CaCl_2$, KCl, $NaHCO_3$ and traces of magnesium. It is available for clinical use with or without strontium added, for roentgenographic contrast.

Serocalcium. Manufactured by Wild in Basle. Composition almost the same as Calxyl. Exposure to light of either of these compounds causes crystallization by the formation of $CaCO_3$.

Dentinogene. Manufactured in Paris. Contains $Ca(OH)_2$ mixed with NaCl. Exact composition is not given.

Pulpdent. An American product. It consists of $Ca(OH)_2$ in a methyl cellulose base (see reports by Berk, 1950 and Berk and Cohen, 1954).

Calcium Hydroxide Water. This has been used to wash cavities and as a styptic to control bleeding from the pulp. The supernatant liquid of a saturated solution of $Ca(OH)_2$ is used.

Since the introduction of Calxyl by Hermann as a medicament for treating exposed pulps, many clinical experiments have been carried out to test the efficacy of this material. There can be no doubt that the majority of researchers, including Lowenstein (1934), Zander (1939), Orban (1941), Aisenberg (1943), Demeritt (1948), Hess (1950), Castagnola (1951) and O. Mueller (1953) have reported in favour of the use of calcium hydroxide as a suitable wound dressing. These were clinical studies and were based on radiographic and clinical criteria. The latter include (a) the presence or absence of pain following the operation, (b) faradic current tests for vitality, (c) evidence of calcific bridging in the radiographs, (d) periapical involvement and (e) completion of physiologic root

formation in young permanent teeth or root resorption in primary teeth.

In 1935, Hermann reported only 11 failures in 700 teeth with exposed pulps treated with Calxyl! In 1940 he admitted that his results had been criticized but even so he claimed 95 per cent success in treating inflamed pulps with Calxyl.

Fenner (1944) at Zurich, examined 194 teeth one to five years after treatment of exposed pulps with calcium hydroxide. Induction current tests, radiographic and visual exploration of the amputated pulp stump were the methods of evaluation employed. Fenner had 11.6 per cent failures in 103 vital amputations. He concluded that age did not appear to be of importance in determining the success or failure of treatment.

Cohen (1951) from the University of Witwatersrand in Johannesburg, reported on 239 cases that had been capped with calcium hydroxide. He found a significant decrease in success with age as indicated in the table below.

10 to 19 years	87% success
20 to 29 years	90% success
30 to 39 years	67% success
40 years and over	53% success

In spite of this, Cohen stressed that capping with calcium hydroxide is applicable to teeth of all ages, with few exceptions. A further point of interest he raised was that there appeared to be less likelihood of failure when bleeding from the pulp preceded the capping.

The report of Castagnola (1953) deserves comment. He evaluated the results of treating 500 teeth. He used indirect capping in 200, direct capping in 200 and vital amputation in 100 teeth. The criteria of evaluation included those outlined above.

DIRECT CAPPING

	15-20 years	23-35 years	over 35 years
No. Cases	81	38	71
% Success	91.4	84.3	87.4

VITAL AMPUTATION

No. Cases	38	25	37
% Success	15.7	16	24.3

The highest success was obtained after indirect and direct capping. The lowest percentage of success occurred after vital amputation since this procedure requires a more difficult and exacting technique than the simple capping of the pulp. He substantiates this by pointing out that more experienced clinical assistants had a 5 per cent greater success than students in carrying out the same procedure. Cohen (1951) also explained that his seemingly lower success than other studies may have been due partly to the fact that students carried out the main part of the work.

Castagnola (1953) found that roentgenograms showed that a dentin bridge had formed over the amputated pulp within two to three months following the operation. Furthermore, Castagnola felt that the first eight to fourteen days were the most decisive in determining success or failure of direct capping and vital amputation of the pulp. This was also observed by Cohen (1951). It should be noted that the studies of Castagnola and Cohen are both commendable in that they dealt with large numbers of cases and these were examined over a significant period of time.

Tananbaum (1951) experienced greater success clinically in treating primary teeth than permanent teeth. He indicated that 96 per cent of exposures covered with zinc oxide and eugenol and considered as clinically successful, did

not show a secondary dentin barrier roentgenographically, after two years. But 89 per cent of the pulps treated with calcium hydroxide did show a calcified barrier within one year. The teeth treated were from patients ranging in age from three to sixty years. A similar finding was made by Strange (1953). She analysed forty-five cases of vital amputations carried out by students. Twenty-nine primary teeth showed a 90 per cent success as opposed to a 75 per cent success with permanent teeth.

In contrast, Shoemaker (1955) had a 55 per cent success with permanent teeth and only 32 per cent success with primary teeth. His very low success might be explained by the fact that he used phosphate cement as the sealing agent. Wittich (1956) also had greater success with permanent teeth than with primary teeth (92 per cent as opposed to 87 per cent).

Via (1955) reported on a study involving 103 primary molars. The amputated pulps were treated with calcium hydroxide and observed over an average period of 24.9 months. He noted that 68.9 per cent specimens exhibited internal resorption. He considered these as failures.

Brinsden (1955) critically evaluated the clinical results in 30 permanent teeth with exposed pulps treated with calcium hydroxide. He re-opened the teeth after a few weeks and examined the amputated pulp for the presence of a calcific bridge and for sensitivity. He also compared the results of direct visual examination with the roentgenographs and found agreement in 66 per cent between roentgenographic and visual evidence of bridging. But if one examines his tables it is seen that only one tooth failed to show bridging roentgenographically. Although this study was made on a relatively small number of teeth, the criteria used were very exacting so that the finding of 66 per cent successful results is not as low as might appear and is consistent with other clinical studies.

Ludlam (1955) used calcium hydroxide in a methyl cellulose base (Pulpdent) on the pulps of 50 selected young permanent teeth and claimed 95 per cent success.

The majority of *clinical* studies report a high degree of success following treatment with calcium hydroxide, and preparations containing calcium hydroxide. Hess (1950), Castagnola (1953), Glass and Zander (1949), Orban (1941) and others feel that the accurate evaluation of treatment may be made only by histologic analysis. Clinical assessments, particularly those using the lack of pain as an index of success, may be very misleading since a degenerating or even necrotic pulp is rarely painful—until secondarily infected. There exists a paucity of histopathological studies in comparison to the number of clinical reports. Nevertheless these have added much to our understanding of pulpal healing.

Histological Studies

Hermann (1930) not only introduced the use of Calxyl for capping the pulp, he also was the first to produce histological sections showing a normal pulp protected from the outside by a bridge of dentin-like substance. Munch (1932), cited by Kundert (1937), used a paste containing calcium salts and vitamin D to treat primary and permanent teeth. After four to six weeks there was an obliteration of the root canals by a dentinoid or cementoid type substance. He observed a metaplasia of the pulpal spindle cells to dentin-forming cells.

Kundert (1937 treated the exposed pulps of healthy six year molars with Calxyl. He observed the formation of a dentin bridge with the alignment of newly differentiated odontoblasts on the pulpal surface. In other, less successful cases, an attempt at bridging was described. Histologically, success was observed in 85 per cent of the cases as opposed to 97 per cent success observed clinically. This difference has been emphasized by Hess (1950) and others.

Teuscher and Zander (1938) reported on the histologic results of two teeth with exposed pulps covered with calcium hydroxide and examined three and one-half months later. One tooth showed a continuous layer of odontoblasts covering the surface of the pulpotomy at the site of amputation. Secondary dentin completely bridged the exposure. The outer layer of the bridge was irregular and showed cellular inclusions, whilst towards the pulp the dentin was more evenly formed with no cellular enclosures, and showing regularly arranged tubuli. The pulp of the second tooth showed signs of hyaline degeneration but bridging did occur.

Rzeszotarski (1939) similarly observed bridging and lining up of new odontoblasts twenty-eight days after amputation and covering with calcium hydroxide. In 1939, P. Mueller showed histologically that canals treated with calcium hydroxide were filled with an outer calcific pulp tissue, and an inner fibrillar substance containing regular and irregular tubules. Some sections showed leucocytic infiltration.

The studies cited above reported the final effects of the calcium hydroxide on the pulpal tissue. The study of Glass and Zander (1949) was probably the first to analyse the process of pulpal healing as a continuous dynamic process. They showed some of the early changes that take place during pulpal healing. They found, after twenty-four hours, that the portion of the pulp in contact with the calcium hydroxide was necrotic. This necrotic zone was separated from the healthy pulp tissue by a zone of deeply staining basophilic material which they called a calcium proteinate. They believed that this layer occurred at the depth of penetration of the calcium hydroxide. After fourteen days, the necrotic zone and the basophilic zone of calcium proteinate zones were still apparent, but against the latter was formed a new area of coarse fibrous tissue, similar to primitive bone, which was only partly calcified. Cells resembling new odontoblasts were lined up along the pulpal surface of this coarse fibrous tissue. After twenty-eight days, a well defined zone of new dentin with adherent odontoblasts was seen deposited against the fibrillar zone. The necrotic zone was no longer apparent. After eight weeks, there was no significant change except that the dentin barrier was thicker.

Zander and Glass (1949) also studied the necrotizing action of phenol to see if it reduced or enhanced the action of calcium hydroxide. Phenol did not appear to alter the pulpal response. In this study they observed bundles of coarse and irregular fibers close to the zone of necrosis, after fourteen days. The fibers were collagenous and arranged parallel to the long axis of the tooth. Condensation occurred around the fibers, giving rise to a primitive type of dentin.

Dausch and Sauerwein (1952) conducted a clinical and histological investigation of pulpal healing in patients whose average age was 56.5 years. The survival period varied from 5 hours to

8 months. They observed a necrotic zone which was sharply demarcated from the underlying vital tissue. They felt that the necrotic process became arrested after two or three days, after which healing began. A necrobiotic area was observed between the necrotic and vital tissue which became calcified and formed a protective layer against which newly differentiated odontoblasts began to form regular tubular dentin.

Nyborg of Sweden, in 1955, published a lengthy monograph on the healing processes in the pulp following capping. Included in his experiments were histological observations of the effect of calcium hydroxide on the exposed pulps of human and dogs' teeth. He described a series of layers which appear in the pulp tissue at intervals following the application of the medicament. At the periphery, there was a layer of superficial debris which contained fragments of necrotic material. Glass and Zander (1949), Kundert (1937), Pajarola (1940) and others had already referred to the necrotizing action of calcium hydroxide. The deeper part of the necrotic zone appeared to contain argyrophilic fibers. Glass and Zander (1949) described the necrotic layer as not being present in sections after fourteen days. Nyborg indicated that the necrotic layer disappeared after two to seven days. A layer of blood pigments was found below the zone of necrosis invading the layer above and the dense zone below. This may be due to the destruction of blood cells in the necrotic process. Below this, towards and within the pulp tissue itself was seen a dense zone of cells, argyrophilic fibers and blood vessels. Below the dense zone was a layer of newly differentiated odontoblasts (the new blastema) which formed the new dentin barrier.

O'Malley (1956) described three zones following experimental pulpotomy in rat incisors. Zone I at the surface, consisted of an area of coagulation necrosis produced by the operative procedures. It contained necrotic debris, dystrophic calcification and immature collagenous fibers present in the pulp at the time of injury. Zone II was characterized by connective tissue proliferation within the vital portion of the pulp, and acute inflammation. A calcific barrier of osteodentin was laid down basal to a scar of mature collagenous fibers within this zone. Zone III showed a slight hyperplasia and mild inflammation of the peripheral portion of the essentially normal pulp. It was an area of transitory changes leading to pulp recovery. O'Malley's study showed that this response was a stereotyped reaction characteristic of the pulp tissue rather than the result of the calcium hydroxide since it occurred not only under calcium hydroxide but also under other calcium salts, bone powder and absorbable gelatin sponge. Zinc oxide and eugenol produced a slightly different response in that the amount of necrosis and bridging were less. Miyamoto (1957) described essentially the same stereotyped pulpal reaction in rat molars following surgical amputations.

Berk (1950), Berk and Cohen (1954) and James, et al. (in press) found that calcium hydroxide in a methyl cellulose base promoted earlier bridging and less inflammation than calcium hydroxide in water. This was probably due to the lower pH and less caustic action of the methyl cellulose preparation.

Antibiotics

It would be surprising if during this antibiotic era, the use of antibiotics had

not been suggested for indirect or direct capping of the pulp, or after pulp amputation, as a wound dressing (Kutscher, 1950; Seelig, et al. 1953).

Castagnola (1953) reviewed, in detail, more than 100 clinical and a few histologic reports using penicillin alone and in combination to cover the wounded vital pulp. In general, these show that the use of penicillin does *not* promote pulpal healing and in fact tends to result in chronic inflammatory changes even when used in small concentrations.

The tetracycline drugs have been introduced more recently and the few clinical reports available tend to laud its virtues (Chatterton, 1952). However, histologic analyses have not yet appeared so that its proper evaluation must await further investigations.

James, et al. (in press) studied the histologic effects of various antibiotics when placed over amputated human pulps. This series showed that in general, the antibiotics did not promote healing and in fact were inferior to the calcium salts in this respect. Penicillin was a definite irritant to the pulp and resulted in increased inflammation, increased incidence of internal resorptions and less bridging. The tetracycline drugs were less noxious but not superior to the calcium salts alone.

The sulfa drugs have also been used to cap exposed pulps. Here the reports are contradictory.

One must await further controlled and histologic investigations in order to properly evaluate the possible future role of the chemotherapeutic and antibiotic agents in pulpal healing.

Summary and Conclusions

The major objective of conservative dentistry is the preservation of a functional tooth with a healthy pulp. From the biologic point of view every method which can keep the damaged pulp alive and healthy is preferable to the best root filling. A healthy pulp also helps to keep the periapical tissues alive and healthy. These statements were made by Hess in 1950 and may be considered a summation of his objectives over forty years of working with the problem of retaining teeth with exposed pulps as functioning units.

One of the major problems associated with vital pulp therapy has been the successful treatment of the carious or traumatic exposure. The last two hundred years have witnessed many changes in the philosophies of treatment. Different schools of thought have risen to prominence, only to be cast aside as newer or more promising methods were suggested.

Empirical methods of trial and error held sway for 100 years. In 1874 Witzel advocated pulp mummification and in 1921 Davis heralded the way for the aseptic era of pulp therapy. Throughout these periods, and even to the present time, pulp extirpation is practiced more frequently than pulp preservation. And during the period when "focal infection" was much discussed and debated, extraction of teeth with exposed (and not yet exposed) pulps was the rule rather than the exception.

In spite of the much quoted statement of Rebel (1922) that "an exposed pulp is a doomed organ," there gradually arose the realization that the dental pulp did possess powers of recuperation and repair. During the past two decades, it has become apparent that the pulp, like any other organ of the body, could heal itself—provided the adverse conditions overwhelming it were removed.

The work of Hess (1929-1950), Hermann (1930-1940), Castagnola (1953), Glass and Zander (1949), Nyborg (1955), Englander, et al. (1956), O'Malley (1956), Miyamoto (1957) and many others has shown beyond doubt that the injured pulp is able to heal with the aid of suitable wound dressings.

Today we are no longer faced with the question whether the pulp can heal, but rather how the process of healing occurs; the details of how the pulp repairs the injury. We are concerned with finding the conditions which might promote or retard wound healing. It now becomes necessary to discover which calcium salt provides optimal conditions for pulpal healing. In fact, the question might be raised whether a calcium salt is essential or merely helpful to the process of healing since some have indicated that pulpal healing occurs equally well under non-calcium wound dressings. We should also know the effects of a blood clot or the age of the pulp on the healing of the pulp tissue. Is the formation of a dentin bridge over the injured pulp the prime requisite for pulpal healing? These are a few of the questions that now require clarification. These are the questions which have ushered in the present "Experimental" or "Biological Era."

It is obvious that the majority of these questions may be correctly answered only through histologic investigations of pulp amputation performed in a suitable animal under precisely controlled conditions. Such investigations require that the pulpal amputations and pulp cappings be carried out on a large scale. A suitable laboratory animal must therefore be found in whom pulp amputations may be performed and the process of pulp healing studied carefully and under controlled conditions, to supplement studies on human teeth. Future studies in monkeys, dogs and rats will undoubtedly do much to clarify the various questions posed above.

It is now hoped that the fine studies initiated by Zander and Glass (1949), Nyborg (1955), O'Malley (1956) and Miyamoto (1957) will pave the way to increase our knowledge of the exact healing process in exposed dental pulps.

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Unit News

THIS lead (pronounced "leed") paragraph, in good, journalistic parlance, has been written so many times, there's practically no more yellow paper.

I failed to send out the postal card reminders (which did such a good job for the first quarter) early enough. But out they finally went. And the response was swell. So I started to write. Then a few more came. And I had to re-write. Still more arrived. Ditto. This went on for weeks. Now I'm not even certain how many reports we have, and I'm tired of counting—then having to change the total. Count for yourself if you're curious.

This much I know—First Quarter reports set an all-time high with 20 Units sending in items.

But—and at long last—on with the News.

Alabama

From the office of President Walter Andrews comes word of a fine meeting his Unit held in April featuring Dr. Walter McFall as guest speaker.

Walt (Andrews, that is), who hails from Birmingham, has been working with a group from the Birmingham District Dental Society for the past year. They formed a pedodontic study club and hold monthly meetings with guest lecturers on subjects ranging from child psychology problems, to case reports on growth and development.

Other officers serving this year are: Randall LaFree, Mobile, vice-president; and Fred M. Haston, Montgomery, secretary-treasurer.

Arizona

For the second of our many reports, Bob Huntington in Phoenix pinch-hits for Secretary Charley Mehlum. The annual meeting was held during their State Dental Association meeting in April at which time new officers were elected. The Unit's yearly scientific meeting featured Dr. Maury Massler of Chicago who presented another fine lecture.

Arkansas

R. L. Smith, Jr., secretary-treasurer for the Razorbacks, says he has the proof that ASDC men are the most active in dental affairs. Three present or past officers of the Arkansas Unit are officers in the Pulaski County Dental Society.

The Arkansas State Dental Association asked the Unit to direct the statewide program during Children's Dental Health Week. All the members really pitched in and made the observance a most successful one. A highlight of their efforts was the placing of outdoor billboard posters calling attention to good dental health. (See cut.)

Dr. Olof H. Jacobson, of Denver, Colorado, was the clinician for the Unit's annual meeting in April. The large crowd present for the breakfast meeting was made up of members, non-members, hygienists, and assistants—and everyone had a fine time.

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NORTHERN CALIFORNIA

Claude Warden, editor of the Unit, really came through in fine style. To quote from his letter, "If we don't have what you want, we'll go out and build it for you." And his attitude is typical of so many of the other correspondents. "You want news—fine, here it comes!"

Lee Winters was named to fill the unexpired term of Tom Beare who had to resign as secretary-treasurer. Lee's post on the Executive Board was filled by Alan Lippincott. Alan's office is in Walnut Creek and Lee practices in Concord.

Not content with a fine roster of 350 members, Mike Lopper, membership chairman, has promised a concerted effort to "pack 'em in." In an attempt to keep the entire membership informed on the Unit's activities, Claude will be issuing a regular newsletter.

"Dentistry for Children in Foreign Lands" was the title of the program presented on February 12 by Dr. Don Jose Aubertine. In April, during the time of the State Dental Association convention, a bang-up breakfast meeting has become an annual affair. This year Francis Howell will speak on "Oral Lesions in Children." It's already a sell-out.

Highlight of the year's activities will be the Unit's Third Annual Pedodontic Seminar. Chairman Charles Sweet, Jr., announces that the seminar will be held at the Ahwahnee Hotel in beautiful Yosemite Valley, September 12 and 13. Dr. Sidney I. Kohn, professor of pedodontics at Fairleigh Dickinson Univer-

sity, and Dr. Eugene West, chairman of the department of orthodontics at the University of California, will headline the program which has as its theme "Space Maintenance, Tooth Guidance and Interceptive Orthodontics." Mr. James Robinson, executive secretary of the Southern California State Dental Association, will also be on the program and will have as his topic, "The Golden Voice of Dentistry."

Reservations must be limited and none will be accepted after July 1, so recall the tale of the early bird. For further information and/or reservations write direct to Chairman Sweet at 2940 Summit Street, Oakland 9, California.

And thank you, Claude Warden!

Southern California

On the same day the Arkansas Unit held its breakfast meeting, the members from Southern California had their eggs and coffee together, also.

The Rev. Alex Nickols was the guest speaker and his subject was "What Makes the Difference?" The program committee felt that "to open a state meeting with a layman's view of dentists and dentistry, especially if it is done by a friend with a terrific sense of humor, would go far in reminding us of the pleasures to be obtained from a successful practice, as well as our relationship to the ever increasing need for community service."

Not a bad idea at all, fellows. Maybe some of the rest of us ought to try a program like this.

Connecticut

Another precinct has been heard from —again! Connecticut's reporter Harold McLaughlin really made up for lost time with the splendid, detailed letter he sent in on their activities. Those fellows may have been quiet last year, but they have been busy!

Hartford was the scene of the annual meeting on May 1 and 2. Dr. Robert Moyer, University of Michigan, will conduct a two-day seminar at the meeting. This is the first time the Unit has sponsored a program of this type, and a big crowd is expected. According to Howard, the Unit is more accurate than the Farmer's almanac in predicting inclement weather since it always seems to be bad at meeting times. But all this notwithstanding, attendance has been good.

Albert Snyder, New Haven, has been chairman of a committee to organize study groups. At present, four are active and several more are in the formative stages. Al has been instrumental in getting one clinic group composed of Unit members operational, and it is hoped more can be developed through the study clubs. The present clinic group composed of Elias Fass, Fairfield, Raymond Crane, New Haven, Irving Mohr, Milford, Ernest Mendeloff, Bridgeport, Norman Feitelson, Westport, and Al Snyder has presented its clinic at a number of local society meetings throughout the state.

Howard pays particular tribute to one member, and for this, here's a direct quote. "Credit for the successful functioning of any organized group usually falls to a successful secretary backed up by an efficient treasurer. Such is definitely the case in Connecticut as this group continues to be fortunate in maintaining the services of Naomi A. Dunn in both offices. We are all most certainly looking forward to her reelection at the annual meeting." Naomi's equally energetic husband, Irving Eichenbaum, as

well as Norman Feitelson were two of those who were given certification by the pedodontic board last fall. Irving will assume the duties of president-elect of the Connecticut State Dental Association this May.

Florida

John Tabak reports that his Unit held an interesting mid-year postgraduate course in Orlando in March. The subject this time was "Interceptive Orthodontics," and Dr. Higley from the University of North Carolina was the clinician.

Of particular interest is the fact that the well-known Dade County Research Clinic in Miami has recently established a section for handicapped under the direction of the chairman of the department of pedodontics at the clinic, Jerry Hagen. (Good dentist—nice guy; we went to Emory together.) In addition, the United Cerebral Palsy Center in Miami expects to have its dental clinic open by the end of May. This clinic, under the direction of Doran Zinner, will be the first C.P. dental clinic in the country housed and operated completely within a parent U.C.P. treatment center.

Good news and good work.

Georgia

The Crackers, too, have their indefatigable secretary in the person of Mary Lynn Morgan. (Incidentally, she and Naomi are real "lookers!") Mary Lynn is currently making plans for her Unit's fourth annual pedodontic seminar which will be held near the end of the summer or early fall. In addition, she volunteered to edit a newsletter, the first issue of which is being printed now.

On February 27, Wilton Marion Krogman, Ph.D., LL.D., Director of the Philadelphia Center for Research in Child Growth, spoke in Atlanta under the auspices of the Georgia Unit and the Georgia Pediatric Society. Frank Lamons, ASDC past-president, was instrumental in making the necessary arrangements. Dr. Krogman deplored the excessive use of "averages" and defined "average" as being nothing more nor less than the best of the worst and the worst of the best. Not bad.

An interim meeting of the Unit was held during the Hinman Mid-Winter Clinic in March. Two visitors present were Sasser Watson, Florida, and Sandy Pike, North Carolina.

Under the guidance of President Charlie Barnwell, the Unit participated in Children's Dental Health Week. Charlie, and his fellow officers, are doing a fine job, and are determined to see a noticeable growth in enrollment before the year is out.

Iowa

Past-President M. A. Dalchow, Maquoketa, writes that successful annual meeting was held on April 14 in Des Moines. Dr. Joe Burkett, Kingman, Kansas, was the clinician, and he discussed the various phases of a pedodontic practice. He is a former pedodontic instructor now in private practice, and admits to being a "plain country dentist."

D. E. Griffith, in Cedar Rapids, sent in a supplementary report to tell us that new officers elected at the annual meeting are: E. C. Prall, Mt. Vernon, president; Merle Bean, Des Moines, president-elect; Miles Olson, Laurens, vice-president; and W. G. Yeager, Waterloo, secretary-treasurer. New members of the executive committee are: Duane

Smith, Des Moines, and L. H. Wagner, Holstein.

Including correspondent Griffith, the Iowans had a fine delegation show up in Miami. The others who made the trek were Merle Bean, Miles Olson, J. J. Imoehl, and E. A. Rizk.

The Iowa Unit is one of the groups currently promoting sectional study groups. Perhaps this is the beginning of a trend. This particular group was started four years ago and grew so much, it became necessary to divide it into two sections. The participants (general practitioners as well as pedodontist) present their troubles, pet projects and/or techniques for approval and discussion. Occasionally the dentist may have his theories resoundingly smacked down, and the arguments (discussions, please!) get hot, heavy—and healthy. However, when the vocal chords have relaxed and the pressure has dropped to normal, the participants emerge wiser, better informed, and, generally, more enthusiastic toward children's dentistry.

Maryland

John Sharpley, secretary-treasurer of this growing Unit, reports that they are certainly making headway. In a midterm analysis of the Unit's activities, John points out that membership has grown from 44 in July, 1957, to approximately 120 by the beginning of the new year and that this figure was expected to climb to 200 by April. (Did you make it, John?)

Four meetings were planned for the year, and the first three have been well received. The most recent was held in March and featured Dr. Jason R. Lewis, Dr. Max D. Largent, and Dr. Charles J. Vincent, all from the School of Dentistry, Medical College of Virginia. Final plans for the last meeting are to be announced.

Ben Crosby, president, in their semiannual newsletter, brought out the fact that the Department of Commerce anticipates an increase in population during the next ten years of 38 million. "Our service to children will and must increase," Ben said. "We have a golden opportunity to extend our practices and build for the future."

As one of the features of the 75th anniversary of the Maryland State Dental Association, the Unit held a meeting and luncheon on May 5. Ben Crosby presided, and Dr. Frank J. Ayd, Jr., psychiatrist, was the speaker. His subject was "The Child in the Dental Office."

Massachusetts

Irrepressible Bob Kirschbaum keeps me up to date on his Unit's doings. And if that isn't enough, president Egil Klinkenberg comes right behind with additional mailings and personal memos.

Incidentally, a letter from Egil in April said he was "still confined to bed with . . . broken bones and torn ligaments. . . ."

Hope you're feeling better and mended by now.

On March 18, the meeting took the form of a "Discussion Clinic." Five men were on the program—Dr. Irving G. Nathanson, "Pre-Surgical Medication for the Ambulatory Child"; Dr. Irving Romanow, "Periodontal Diseases Associated With Puberty"; Dr. Morris Glasser, "Endodontics for Children"; Dr. Abraham Nizel, "A Step by Step Technique for the Detection and Correction of Nutritional Inadequacies"; and Dr. S. Patrick Scavotto, "Dental Radiogra-

phy for Children." Sounds like it must have been a fine program.

Dr. Kenneth Easlick, Michigan, was the speaker for the May meeting, which was held during the annual meeting of the Massachusetts State Dental Society. His Subject was "Where Is Research Taking the Children's Dentist?"

Aha! The mystery is solved. Some more of that late mail brings word that Egil's infirmity was due to a skiing accident. Toes were wired for traction to set three fractured metatarsal bones. Egil says everyone treated him so kindly (where the accident occurred) that he feels even more strongly than before "that people are wonderful." And he's right. In fact, they're nicer than anybody.

Michigan

George Guest, capable president of his Unit, says he was glad I missed the deadline because it gave him a chance to gather some additional material, and he sent in a fine report.

Last October the Unit met jointly with the Detroit Pediatric Society at a meeting sponsored by the Crippled Children's Home. Joe Cabot was instrumental in helping to arrange this joint effort. More than 120 were in attendance for the interesting program. Walter McBride and Sam Harris, founders of the Michigan Unit, were recognized.

Hugh Kopel was chairman of the Unit's Children Dental Health week committee and did a great job. He had ample help from members Graetz, Konikow, Guest, Shumaker, Hegan and Bartoszewicz. Walter McBride spoke on Dentistry for Children at a Children's Dental Health Day program on January 29. Al Seyler was also on hand to lend support. The evening's program, following dinner, featured Ben Rabinowitch, California, on "Tooth Guidance, Preventive Appliances, and Endodontics for Children." Dr. Joseph Muhler, Indiana University, discussed "Current Developments in Topical Stannous Fluoride." Sam Harris brought along two distinguished guests from far away—Dr. Benjamin Gomez, from Bogota, Colombia, new president of the Pan American Council of Dentistry for Children and Dr. Cruz from Mexico. Milt Gellin of Cleveland was also present.

Harold Maxman has been spending a lot of time and effort giving endodontic clinics, and he presented one in Cleveland for their Dental Health Week program.

Missouri

On May 5, Dr. Joseph Burkett, of Kingman, Kansas, spoke to the Unit on "Pedodontics in General Practice." All Missouri and Kansas A.D.A. members were invited to attend. Iowa reported that Dr. Burkett made a fine impression at their meeting so this one must have been successful, too.

Minnesota

L. H. Schwarzrock, Minneapolis, sent in an excellent report and appended a personal note saying he would be glad to receive any help. From the information received, I can only say, L. H., you're doing fine all by yourself!

As he puts it, the Minnesota Unit has been going great guns. Monthly meetings are held on the third Tuesday in Minneapolis. In addition, one meeting is held in some other city and one meeting is an all-day session. Dr. Thomas Barber, University of Illinois, was the January speaker and his address was titled, "Let's Look at the Dentist and His Personality."

In February, Mr. James Rothenberger,

official photographer at the University of Minnesota School of Dentistry, discussed "Techniques of Dental Photography." A film was also shown illustrating the stainless steel crown techniques.

Dr. Donald O. Erickson, Minneapolis, charter member of the American Academy of Dental Practice Administration, was the speaker at the March meeting which was held in St. Cloud, Minnesota.

Election of new officers took place at the May meeting which also was a social event since the wives were invited to attend. The all-day meeting is scheduled for September 12. Last year, 225 men attended from seven states, and an equally large group is expected again.

Like I said, you're doing fine, L. H.—just fine!

Montana

Members from far off Montana will hold a meeting on June 21 and 22 in Yellowstone Park at the Canyon Village. Dr. W. P. Humphrey from Denver will be the clinician. Election of officers will also be held.

V. V. Crissey, Livingston, writes that although the Unit was organized only three years ago, they have held four previous clinic meetings with equally outstanding speakers.

New Mexico

Arthur J. Wagner, Albuquerque, was recently re-elected president and his fellow officers were also chosen to succeed themselves. They are: James Matthews, vice-president; and I. L. Voda, secretary-treasurer. Bernard Levin and Secretary Voda were named delegate and alternate respectively to the Dallas ASDC meeting.

An excellent one-day seminar was presented by Dr. Clinton Emerson, head of the Pedo department at the University of Southern California. His subject was "Patient Management, Interceptive Orthodontics, Operative Dentistry and Space Control," and his lecture was illustrated.

Membership is growing slowly, Correspondent Voda reports, and the Unit, in general, is enjoying good health.

New York

Happy Birthday! Rochester was the scene of the 25th birthday celebration of the New York Unit. Guests of honor were the past presidents ranging from Glenn Whitson, 1933, to Dan Tobin, 1957. The program's featured essayist was Dr. M. Michael Cohen, Boston. In addition to his presentation, there were numerous table and projected clinics. The ladies, of course, were not to be forgotten, and a full schedule of social activities was planned. All this and more has been reported by genial president—and excellent correspondent—Bob Burchesky of Utica.

New York City will be the scene of the 1959 ASDC meeting and plans are already well under way. Bob assures us the Empire State will be ready, willing and able to receive us all. He knows this is so because the general chairman is M. Joel Freedman, and he is already working hard.

Congratulations to Bob on concluding his term of office and to his successor, Abe Kobren, White Plains.

Incidentally, the May issue of the *Bulletin* of the N. Y. Unit, edited by Joe Kauffmann, was really well done. Celebrating the 25th anniversary, the issue was dedicated ". . . to the advancement of the best possible dental and systemic health for every child in the world, without distinction as to race, creed, nationality, political, social or

economic status." Well said—and a tip of the old Ivy League cap to you, gentlemen.

Pennsylvania

Manny Album, for the Keystone state, reports all sorts of interesting programs.

Back in January, the Philadelphia Section and the Pennsylvania Unit presented a one day course on Children's Dentistry. Dr. Ben Rabinowitch, Los Angeles, was the speaker for the all day session. On May 14, the Philadelphia group presented a panel discussion at Temple University on Interceptive Orthodontics. The panel was under the direction of Jim Dannenberg, President. Working with him were Ed Cherkas, A. H. Lubowitz, Manuel Album, Jerome Sklaroff, and Raymond Werther—all of whom are either pedodontists or orthodontists.

Just one week later—on the 21st—the Pennsylvania Unit held its state meeting. Dr. Sidney Kohn, professor of pedodontics at Fairleigh Dickinson, spoke at the afternoon session on Interceptive Orthodontics. The evening session featured a panel on the Fractured Anterior Tooth, and Dr. Kohn, Dr. Joe Bunello, Dr. Jay Segal, Dr. Dick Miller, and Dr. Manuel Album participated.

If nothing else, those Quakers will be educated!

Rhode Island

Looks like the Rhode Islanders have done it again—three times to be exact!

It started back in February when Dr. M. Michael Cohen spoke to the Unit on "Prophylactic Orthodontics for the General Practitioner." Dr. Cohen, author of a new textbook, *Pediatric Dentistry*, lectures at Tufts and is a consultant for the Public Health Service.

Then, in March, Dr. Frederic Shiere, chief of the pedodontic department at Tufts, lectured on a most important topic, "Let's Get Back to the Fundamentals." As the Rhode Island executive committee asked its members, "Are you really interested in performing . . . the best operative dentistry?" As can be imagined, this must have been an illuminating meeting.

The April meeting added to the momentum of good programs. A panel of orthodontists discussed subtle and gross malocclusions in relation to growth and development so that "the family dentist can recognize the complexity of the problem at hand." Melvin I. Cohen, Julian M. Rothblatt, and Leonard T. Swanson—all on the orthodontic staff at the Harvard School of Dental Medicine—comprised the panel.

Tennessee

One of the highlights of activity in the Volunteer state, as reported by President Bob Pope, has been the activation of a local group in Chattanooga. Leaders in this effort were Ruben Dubrow and Robert Steel, pedodontists there, and Carl Holmes of the Health Department.

On May 11, just prior to the Tennessee State Dental Association meeting, the Unit held its state meeting in Chattanooga. It was a hectic—but worthwhile—day for those attending, and Dr. J. Dale Welsh, director of the Speech and Hearing Center in the Chattanooga area, spoke on problems pertaining to speech and hearing defectives.

Main essayist for the Unit was Dr. Galen Quinn, head of the department of pedodontics at the University of Tennessee. His subject was "Constructive Dentistry for Children." Bob says Dr. Quinn's reputation is growing rapidly, and this writer can add a word by saying

that Galen is as personable a young man as you could want to meet.

Looks like my neighbor state is trying to keep up with us—and I think they're gonna do it!

Memphis Section

Now this is one I didn't know existed. But they sure came through with a fine report so, "Welcome aboard!"

A kick-off dinner was held in March, and the subject was "Behavior Problems in Children." Dr. J. G. Hughes, professor of pediatrics, College of Medicine, University of Tennessee, was the lecturer.

This was followed up in April by a meeting discussing "The Use of General Anesthesia in Dental Operative Procedures." Dr. W. H. L. Dornette, head of the department of anesthesiology at a Memphis hospital, was the speaker, and Galen Quinn and his pedodontic staff at U. of T. assisted.

This must be a pretty good group because their programs for the entire year are planned and information about them will appear in this space periodically. (But who is the correspondent?)

Washington

Like the Arkansas Unit, the Apple State men had the honor—and responsibility of directing Children's Dental Health Week. (See JASDC, First Quarter '58.) One of the "gimmicks" employed was quite clever. The committee contacted the Apple Association with the idea of placing apples in the reception rooms for distribution to children patients during the week. The idea was well received and met with great enthusiasm by the givers and receivers.

Teacher Workshops were also given during the week with the cooperation of the State Health Department. Lectures were presented on nutrition, proper home care, and all the various ramifications that come from the expression, "dental health." This, of course, was in addition to the usual radio, television, and newspaper publicity.

Bob Morrow, Opportunity, newly elected correspondent for the Washington Unit, couldn't pass up this "opportunity" to send in a lengthy report with lots of news. Thanks, lad, and let's have more of the same.

In April, Dr. L. S. Fosdick, professor of chemistry at Northwestern University, spoke to the Unit on "Recent Advances in Caries Research." This fine meeting was followed in May by a day of panel discussions and clinics, sponsored by the Unit, for the graduating class at the University of Washington Dental School.

Dr. George Boone, department of orthodontics, University of Southern California Dental School, will speak to the Unit on growth and development, differential diagnosis between tooth guidance and orthodontics, principles of occlusion and malocclusion, and treatment planning. Then, in September, the men will participate in the third annual Pacific Northwest Conference on Dentistry for Children. Details will come later.

Thanks again, Bob. This makes two tremendous reports in a row—and this I like.

Wisconsin

Springtime brought Unit members to Milwaukee for an interesting and unusual program. Otto Minshall, outgoing secretary-treasurer, reports that a goodly crowd—including wives—showed up.

Dr. S. A. Lovestedt, Oral Surgery Section, Mayo Clinic, was the first speaker. His subject was "The Recognition of Systemic Disorders in the Child Dental

Patient." Miss Josephine Simonson, speech consultant at Mayo, was the second speaker. Her subject was "Speech Studies of the Oral Mechanism."

New officers have been installed recently. They are: W. Newby, Waukesha, president; L. B. Crosby, president-elect; James Helz, vice-president; Fred Druse, Wauwatosa, secretary-treasurer; and Leslie Condon, councilman for three years.

ADDENDA

Word comes from Kenneth E. Wessels, professor and head, department of preventive dentistry and pedodontics, School of Dentistry, State University of Iowa, about an upcoming "practical course on pedodontics."

It is a one-week session from September 15 through the 19th, and enrollment will be limited to 12. Registration fee is only $50.00. The curriculum as outlined in his letter is certainly impressive and seems to cover the field rather thoroughly. Details and further information can be secured by writing to Dr. Wessels at the University in Iowa City, Iowa.

* * *

Tony Montero, the dynamic secretary of the Pan American Council of Dentistry for Children, from Havana, reports that his association is still going strong—and getting stronger.

New officers along with Tony are: Albert L. Anderson (our very own!), U.S.A., president-elect; Maria I. Navarra, Uruguay, vice-president; Alicia Lazo de la Vega, Mexico, treasurer; and Carlos Criner, Cuba, Editor.

It would be an impossible task to try to condense Tony's excellent newsletter into the space available here. Maybe a few highlights will suffice. Some of their projects are: efforts to spread the word about the importance of fluoridation with the idea of having it put into effect wherever possible; starting a program of compulsory dental care for school children leading to issuance of dental certificates; anticipating an exchange of educational material between the A.D.A. and affiliate societies of the Pan American Council; providing facilities for school children in need of dental care; and—perhaps most important—recommending to all schools on the American continent that do not now include pedodontics in their curricula as an official subject to do so.

These are certainly ambitious men and women, and they deserve a great deal of credit. We in this country, where dental services are available to such a great degree—at least as compared to other areas of the world—are apt to forget that our neighbors have tough rows to hoe to achieve even minimum standards.

* * *

The Eastman Dental Dispensary recently celebrated its 40th anniversary, and on that occasion, Dr. Elmer J. Pammenter, Rochester, N. Y., was presented the first annual Eastman Dental Alumni Award. He has been a consultant to Eastman Dental Clinics throughout Europe and organized dental clinics in a number of rural school districts in western New York. The award was given for his "outstanding contributions to children's dentistry."

The Texas Unit is anxious to sign up table clinicians for our National Meeting in Dallas. Write to either M. M. Sharpe, 3307 Elgin Avenue or H. O. Simmons, 2350 34th Street, both in Lubbock, Texas, for further information.

FINALE

This issue has 23 Units reporting—and that is sensational. Of course, the ideal will be reached when each Unit submits a report at the same time—and it could happen. Just watch for the postal card reminders—and write back.

While on this subject, I might mention that we could use more pictures of you and what you're doing. When you send one, though, be sure to include a caption with all names and other pertinent information.

A number of you have written me in the last few months wanting to know "how come" your items did not appear in print. By now, however, I imagine you have all been satisfied because another issue of our JOURNAL has appeared. Sometimes your items will just miss one deadline and, consequently, it could be several months before that particular bit shows up. But show up it will, I guarantee.

You might also notice that Editor Al Seyler has made some changes in deadline dates, and this should help clear up the problem of late publication dates which you have also been inquiring about. Each of us has a deadline—you to me; I to him; and he to us. But we have to work together to make it come out right. We will—and it will.

Material entered for Unit News should be sent to Ted Levitas, 340 Boulevard N. E., Atlanta, Georgia. Deadline dates are: Second Quarter, April 25; Third Quarter, July 25; Fourth Quarter, October 25; First Quarter, February 25.

'Of the Mortality of Young Children at The Time of Teething'

PART II

(Continued from First Quarter 1958)

CHAPTER II

DIVERSE CARES WITH WHICH ONE MUST SURROUND THE CHILD DURING THE FIRST THIRTY MONTHS OF HIS EXISTENCE, THE PERIOD OF THE PRIMARY DENTITION

I WOULD only be half fulfilling the object that I proposed for myself in writing the preceding chapter, an object which consists in keeping the child safe from the perils which surround him during the labor of teething, if I did not complete these instructions by an account of the secondary cares which corroborate the effectiveness of the diet.

In fact, although the perfect harmony of the feeding with the needs and the strength is, for the newborn, I repeat it, the first condition of good health, meanwhile you should not ignore that there are certain hygienic precautions which contribute powerfully to defending him against the injurious influences of the dental eruption.

The first and the most important of all the rules to observe with regard to infants during the thirty first months of their existence is to protect them from the ill effects of cold, source of a flock of troubles more or less dangerous. Everything shows that cold is the mortal enemy of living beings, while heat, on the contrary, is the most powerful and most active agent of life. The study of nature offers us, on this subject, a multitude of observations which place this double principle outside of doubt, and from amongst which I shall choose only the following:

1. One sees animals instinctively prepare the nest of their little ones in the best sheltered retreats, gather around them the substances most capable of conserving or developing heat, cover them with their bodies; in a word, to resort to all the ways suggested by maternal instinct to shelter them from the onslaught of cold.

2. The sudden or abnormal drop of the temperature acts, according to the unanimous testimony of the breeders, in a fatal manner on the organs of young animals.

3. Almost all living beings, no matter what the degree of their intelligence, seek out eagerly the presence of heat and of the sun.

4. At the approaches of frosts, the body of the most hardy beasts fortify themselves with thick furs.

5. Winter, which puts to death or benumbs a quantity of creatures and of vegetables, is for nature a time of lethargy; the spring, on the contrary, which regenerates and enlivens, is for her a signal of resurrection. The reason, it is that the first proceeds under the escort of the cold, so teeming in germs of death, and that the second inaugurates the return of the heat, source and vehicle of the vital fluid poured out in all creation.

6. Finally, one observes that of all children of the human race, the most disinherited, in respect to stature and vigor, are the Laps, who, relegated to the ends of the world, spend their life in the midst of eternal ice and far from the benificent rays of the sun.

I should like to multiply the examples, but those suffice without doubt to convince the most incredulous, that the cold is as detrimental to the child as the heat is advantageous to him. This principle recognized, how is it not necessary to deplore, how is it not urgent to banish this extravagant fashion by virtue of which one makes a game of exposing very young children half nude to outside air, in the most rugged weather, in the vain and ridiculous pretext of acclimatizing them to the inclemencies of the seasons?*

That the author of Emile takes pride in subduing nature and in moulding it to his fancy, that is perhaps the role of a philosopher; but that of a doctor is to observe the laws which preside over the development and the preservation of man, and not to permit that people detract from it; for one never violates them with impunity.

Perhaps you will raise an objection to me that, under the foggy aud chilly sky of Great Britain, the children are nevertheless subjected, from their young age, in a state of semi-nudity, to the influence of the free air. I would answer that this insult to the precepts of hygiene carries with it its punishment. It impairs and corrupts the sources of life, and spreads pulmonary and scrofulous infections, which afflict, without distinction for rank, all the classes of the English population; in that country, a considerable number of children perish at the time of teething.

The newborn, once more, is a feeble and delicate plant, which fears contact with a rigorous atmosphere and wants to be raised warmly. This need for warmth makes itself felt especially at the time of the birth of the milk teeth, and you could not imagine the number of these frail creatures who paid with their lives for the wrongs of imprudence and of prejudices. But even when this critical period is passed over, it is not wise to leave the child exposed without sufficient protection to the malignity of the cold and the humidity, and I maintain that tepidity of a comfortable apartment is, in all cases, much more favorable to the development of the organs than the walk in the open air when the thermometer goes down in the neighborhood of zero.

Does this mean that it is necessary to keep children constantly shut in and

* What would one think of a gardener who had the intention of acclimatizing an orange tree, and who, in order to do this, exposed it in full winter to the rigor of the weather?

to cover them excessively? No, without doubt; an excess of good produces evil, and it is to violate a principle to exaggerate it. The skin only accomplishes regularly the functions which are vested in it on the condition of being maintained at a degree of moderate heat. Let the body of the child be kept in an equitable balance of temperature; let the hand, in touching its surface, find there neither cold nor perspiration, that is the unimpeachable indication of a perfect state of health.

As to the nature of the clothing whose usage it is proper to recommend, you understand that I would not want, on this essentially variable point, to establish uniform rules. The age, the constitution, the climate, the season, are many of the circumstances which must be borne in mind, and which must determine, in the eyes of the parents, the seasonableness of such or such clothing. Always it is an unalterable principle, and its application admits no exception, to know, that you should never fear to provide for the extremities a considerable amount of heat.

The confirmation of this truth arises from the treatment that we have to undergo for illness resulting from inflammatory or plethoric maladies of the internal organs; all efforts strain to restore the blood toward the extermities, with the help of an intense heat produced by the immersion of the feet and hands into some water heated to a very high degree, by the application of mustard plasters, of cupping glasses, and by all sorts of powerful ways. If then you submit the limbs of a child, sound and in good health, to a procedure diametrically opposed, that is to say if you keep them constantly in contact with the cold, is it not evident that you put an obstacle in the way of the regular distribution of the blood in the venous network, that you bring about in the long run a forcing back of the fluid toward the viscera; from whence inevitably will arise cerebral congestions, obstructions of the glands, of the lungs, of the intestines, colds, croup, false croup, finally all the ills to which early infancy is tributary.

What to conclude from that which precedes, except that, far from uncovering the legs of children of young age, following a custom unhappily very common, it is of the utmost necessity to clothe them warmly. Good, thick woolen stockings, rising to the middle of the thigh, constitute an attire less elegant perhaps, but unquestionably very preferable to the Scotch undress that, without regard for their well-being and their health, is inflicted on these poor little creatures. I advise also the parents whose children display a frail and delicate constitution, to make them wear shirts of flannel until the entire completion of the travail of the first dentition. A number of newborn, whose weakness made them eminently vulnerable, have owed their health to this simple hygienic measure. I do not deny that you may see children flourish and prosper in the absence of all precaution of this kind. But what does that prove, except that nature has vested in some a vigor that she refused to others, even as she endowed certain shrubs of our forests with the privilege of growing and of bearing fruit despite the intemperances of the seasons, while she condemned other bushes to perish, if the foresight of man does not shelter them from the rigors of the winter? I add that the insufficiency of clothing is fatal to weak children, without present-

ing any real advantages for robust children, instead of which the contrary system, so abundant in benefits for the first, is without inconveniences for the others.

One essential particular to note, is that the reaction is not brought about without an extreme difficulty during infancy; in other words, the body, once chilled, only gets warm very slowly. One naturally deduces this inference from it, that the ablutions must be, particularly in winter, practiced with tepid water unless the use of cold water is followed by vigorous rubbing. The newborn suitably sponged, is then rubbed on all the parts of the body with the aid of a piece of very dry linen; after this operation, you swaddle him, or dress him, avoid squeezing him in his clothes for fear of impeding or interrupting the circulation of the blood. As for what is necessary for bedtime, you shall give preference to mattresses of oaten chapp or of fern, strongly enough stuffed so that they give with difficulty under pressure. Their resistance will contribute to strengthening the muscles of the child and fortifying his health. Care shall be taken to cover the nursling warmly in his cradle, but without overburdening him with curtains, which are only good for hindering him from breathing easily, in imprisoning him in an atmosphere stagnant and saturated with his own emanations.*

No washing of the head. The passage of a soft brush and a piece of dry linen suffices to cleanse the scalp of the foreign bodies which adhere to its surface. It is to be noted that the scalp is found, in those of young age, in a state of permanent transpiration, eminently favorable to teething. But, the dampness which follows after the washing risks suddenly stopping the flow of this excretion and making teething laborious by removing from it this powerful auxiliary; decisive reason for forbidding the use of lotions in the cephalic region, even though the presence of hair on the head of man would not indicate that nature wished to shelter the skull from all dampness coming from the outside.

To abstain from rocking children with violent jerky movements and tossing them up brusquely in the arms, for fear of causing injury to the cerebral organs; to avert from them all light too bright, all sound too loud, all odor too penetrating, in a word, all that is capable of irritating the sensitiveness of the organs of sight, of hearing and of smell; such are further the precautions that I recommend. Let us never forget that the delicacy of the springs of these fragile machines requires the most minute cautions, and that the excitation provoked in some essential organ reacts most of the time on the jaws, seat of a great momentary activity.

I add that it is of the highest importance to keep the child to his room as soon as some symptom of indisposition manifests itself in him. Should he begin to feel tormented by an acute tickling in the gums, which he denotes by the

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* It is well understood that the precautions that I recommend are only relative to the early age of life, from birth until the complete eruption of the teeth, which does not go ordinarily beyond the third year. From this moment on, it is to the purpose, on the contrary, to change the regime and to relax these cautions. It is time that the child learns progressively to become a man.

persistence of carrying his fingers to his mouth, you should combat the development of this local itching by gingival rubbing with the help of the *teething syrup,* whose qualities and use I have pointed out in a special work.

If you conform exactly to this little code of prescriptions as much preventative as curative, without neglecting moreover all the usual domestic cares and among others cleanliness, you will have little to fear of, except in certain exceptional and very rare cases, a difficult dentition; for this completely natural phenomenon is purposed to come about peacefully, and is only metamorphosed into a crisis through a course of imprudence, of carelessness, of ignorance or of a bad system of feeding.

You will doubtless read with interest the following letter which forms the natural complement of the two chapters which precede. This letter, written 500 years before Jesus Christ by a pythagorean to one of her friends, attests that antiquity had carefully studied the hygiene and the correct diet for early infancy. You will note how much analogy there exists between the precepts contained in this little digest of motherhood and some of the principles that I just expressed.

LETTER FROM MYA TO PHILLIS

"You are going to become a mother; your first duty is to occupy yourself with the choice of a nurse. May she have enough control of herself to constantly refuse the caresses of her husband; may she be neat and modest; may she have neither the passion for wine nor the love of sleep; may her milk be pure and nourishing. On the choice that you are going to make, depends the entire life of your cherished child.

"Every moment of a good nurse must be apportioned amongst her duties. She must consult prudence and not her fantasy, her whim, in order to present the breast to the nursling; it is in this manner that she will fortify his health. It is no less necessary that she wait to surrender to sleep till the child has a mind to settle down.

"Take care that she not be of a choleric disposition; I would not learn with pleasure either that she was a stutterer; strive also that she be born in Greece, for fear that, by imitation, your child does acquire a faulty accent. Above all may she be prudent in the choice of her foods and may she only take nourishment with appropriate caution.

"It is good to let children sleep after they have been well fed with milk; this pleasant rest, and their weakness requires it, makes their digestion more easy. If it is absolutely necessary to give them some other nourishment than the milk of the nurse, do not forget that it must be simple and light. I believe that wine is too strong a drink for them; if you do not refuse it to him entirely, let it be at least diluted enough to come near to the sweetness of milk.

"I would not advise bathing them every day; it suffices that they take a bath from time to time, and it is essential to well regulate its temperature. Do not study with less attention the question of the air that your child will breathe; let him experience neither too great heat nor too rigorous cold. His room must be neither too closed, nor too exposed to the wind; the water that he will drink,

neither too light nor too heavy. Do not give him clothing too rough; let them have enough fullness to cover him, too little to inconvenience him. Nature must be your guide; she demands that his needs be satisfied; she does not want magnificence."

CHAPTER III

SURVEILLANCE OF THE JAWS IN DEVELOPMENT –HYGIENIC CARE OF THE GUMS–ON THE PRURITUS OF TEETHING

THE first quests towards which I directed the course of my observations had only one end; it was to fathom the primary cause of the convulsions to which infancy is so often subject during the time of the first dentition; but I was not long in perceiving that the plan of my studies enlarged of itself; for I discovered, on the way, that not only convulsions, but also diarrhea, vomitings and irritations of all kinds to which the early age is tributary, came from a common source. These diverse affections are manifestly only the varied consequences of a unique principle, the state of the jaws in labor, of which I feel confident of being able to convince all enlightened and conscientious people.

Thriving up until the teeth, such is the common saying, picturesque in its briefness, but which experience has suggested to the women of the country; it bears witness to this frequently observed truth, namely, that we see such a child, robust and healthy during the first months of his existence, waste away and contract all kinds of illnesses at the time of calcification, development, and eruption of the teeth.

This phenomenon has been commented upon very diversely.

Some have maintained in an absolute manner that teething should not give rise to any accident: according to them, the maladies which rise at this time would only be the natural and inevitable development of predispositions inherent to the primordial constitution of the subjects.

Others, on the contrary, have set up a formidable nomenclature for all the ills whose origin they attribute to this operation of nature, so that to understand them it would be necessary to consider the period of teething as a peril almost impossible to surmount.

Some have attributed all the disorders which occur in the health of the children to a pernicious pressure sustained by the vascular-nervous cord placed at the base of the alveoli; pressure resulting, in their opinion, on one side from the continued growth of the roots of the tooth, on the other side, from the obstacle opposed to the eruption of the crown by the contraction of the alveolar isthmus.

According to the latter, the teeth act with the alveoli in the manner of wedges which should by separation cut a way for themselves, and the restraint that they exercise on these last organs, they claim, brings about to the environs an inflammatory irritation which, gradually, spreads sympathetically in the economy.

The former claim that the irritation is the effect of the inflammation of the

dental pulp, or of the compression of the periosteum, or even still of the state of the nerves compressed between some parts which become calcified, or finally of the excessive strain and of the laceration of the gums.

Most people, halting at the surface of the phenomena, are convinced that the alveolus is worn out under the action of the tooth that transpierces it, and that the gum is perforated by the dental crown in the same way that parchment could be pierced by a stiletto; thus the violent pains caused by the eruption of the teeth and the accidents which flow from it. This last belief, the most accredited of all, passes for an article of faith, notably in the opinion of rich and fashionable people in whose homes one hears said generally:

"That child is ill because he is *cutting* his teeth."

So many systems, so many errors. I have developed in the chapter on anatomy* the method of germination, of ossification, of progression and of eruption of the teeth. The facts are in direct contradiction with all the theories that precede. As they start out from absolutely false principles, there is not one of them that does not arrive at a conclusion very far from the truth.

What phenomenon takes place then in the jaws of a great number of children which give birth to some crises whose end is so often fatal?

Is it the pain?

Are there organic injuries?

What then is the determining cause of these disorders which all of a sudden come to trouble the health and jeopardize the life of so many young creatures, flourishing before the period of teething?

A question of very grave interest, since it was, as I have said before, put into competitive examination, as early as 1781, by the Royal Society of Medicine of Paris and that, despite the prize attached to the best solution, it still remains to resolve. In fact, statistics had proved, at this time, that there died each year, because of the illnesses from teething, a sixth part of children of young age; and the tables of mortality give the proof that this proportion has remained the same, even though the method of treatment has been completely changed.

The reports made up until this day on this matter, as obscure as it is interesting, had then resulted only in complicating the problem by multiplying the conjectures. I have absolute confidence of having resolved it by the discovery of the *pruritus of teething*. In my conviction, all the affections which result from the eruption of the milk teeth are the products more or less direct of a local tickling which, in reacting on the nervous system, hurls trouble into the diverse functions of the economy. It is that that I can demonstrate by the detailed examination of the course that the development of a dental crisis follows.

At the time of the formation and the calcification of the first teeth, the child is not yet in possession of the faculty of speech but he is nonetheless in a state of translating very clearly by his pantomime and by the different intonations of his inarticulate cries, the painful or agreeable impressions that he feels. Well, then, observe him at the beginning of the travail of teething; his first feelings

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* Work on the *Accidents of Teething*.

are manifested by a significant movement: he carries his fingers vigorously, but without cries, to his mouth and with obstinacy rubs his gums. Does this action imply a feeling of suffering in him? Evidently not. Let an insect just brush past my face, let the feathers of a quill glide over the skin of my lips, of my eyelids, or the inside of my nostrils, so instinctively does my hand go to the affected area. Is this gesture the effect of a painful shock? Not at all; it has no other motivation than the tickling caused by the presence of an irksome body.

The nursling who suffers cries out in complaint and bursts into tears; a pricking, a burn, a stomach ache cause at the same instance his tears and his cries to gush up. This is what would not fail to occur at the onset of the dental eruption, if his first attacks were accompanied by pain. But from the moment that the sole demonstration of the infant consists in silently pressing his fingers on his gums, is not one justified in thinking that what he is feeling is of a different nature? And what could this be except a feeling of pruritus, of itching, of tickling?

The best proof that the gum is by no means made sore, is the ease, I should say more, the expression of joy, with which the child troubled by teething permits enduring the hand there; it is the eagerness that he employs to seize and to bite all the bodies capable of opposing a resistance to the pressure of his jaws. If his gum was the seat of a clearly characterized pain, you would see him, on the contrary, protect this organ from the lightest contact, for the nature of the pain is to magnify, in the region in which it gets a hold, the sensitiveness of the tissues.

You could not, without bad faith, refuse to conclude with me, from the preceding observations, that the child experiences in the beginning only an itching, a tickling of a particular kind, an effect purely nervous, that I denote under the name of *Pruritus of Teething.*

But what is the cause of this tickling? Nothing is more easy than recognizing it.

In normal conditions, the dental sac* simply congested, functions without provoking any disorder, that is to say, it keeps within the bounds of destroying the obstacles which could resist the eruption of the teeth. But if by lack of care, or by some cares ill understood, such, for example, as a faulty diet; in a word, if, by some deviations of regimen, the dental sac becomes the seat of a local irritation, there breaks out in the jaws an itching, which, little by little, mounts, to the most intolerable twinges if you do not set it in order.

It is essential to note that it is only after they have for a long time played their fingers on their gums, without complaining, that the restlessness ends in overtaking the children in whom teething must take place with pain. At that time they are agitated, they turn about, they turn about again, they writhe in every direction; then they finish, through despair, by emiting furious cries, but such cries that an experienced observer could not mistake them for the groans and the wailing exacted by the pain. No tears, no sobs, nothing but expressions of anger and of rage, convulsive outcries, equal to those which

* See the chapter of anatomy in the work of the author on the *Accidents of Teething.*

escape from nervous people subjected, despite themselves, to a prolonged tickling.

Reckoning from the moment when the pruritus of teething has taken on this quality, it becomes the terror of the child and the mere approach of an attack suffices to renew his agonies. There is the cause for the almost incessant cries which certain subjects utter during the period of teething.

The most troublesome effect of this state of things is that the shock to the nervous system which results from it throws disturbance into all the vital functions; sleep disappears, the appetite vanishes, the digestions get out of order, and the inevitable results of these disorders are fever, diarrhea, vomitings and convulsions.

What! You will say, could a simple tickling have such serious consequences? Yes, without doubt: I could cite a thousand proofs of it. The bite of certain insects, although little painful in the main, does it not degenerate, in the long run, into a veritable torture? Do you not often see a horse, the most peacable by nature, rear and run away under the influence of an irritation caused by the flies which harass him? Finally, do we not know, by the fable of LaFontaine, that a gnat is enough to put to torment the most powerful of animals?

But without looking beyond my examples, I address myself, reader, to you.

I grant you an irritable and nervous constitution, and I imagine that one dares to tickle you lightly on the soles of the feet; let this titilation be repeated several times in the course of your meals, let your sleep be troubled every moment by the same torment; do you believe your health resistant to a similar irritation? Do you believe that if it is renewed during days, weeks, entire months, your constitution will resist this pernicious influence, that your digestions will be able to be carried out regularly, that your strength will be repaired in the agitation of a constantly interrupted sleep? Certainly not! Well! this torment whose picture terrifies even you is the one that a large number of children endure at the time of the primary dentition. Why be astonished that a notable part of these frail creatures succumb to it? The bad digestions engender fever, diarrhea and vomitings; a constant excitation brings about convulsions; finally the want of sleep is followed by phthisis, decay, and from these continued accidents rises a general disorganization which leads rapidly to death.

It is therefore evident that it is to the excitation of the nervous system, stimulated and fomented by the itching of teething, and not to some pains due to the supposed efforts of the teeth to pierce the gums, that we must attribute most of the ills of the primary dentition. If the dental eruption took place in the same way as it is surmised, by way of perforation, is it not evident that the suffering would not spare any child, since the pressure of the tooth would render the gums equally painful, in one child as in the other? Meanwhile, we know that it is not at all so and that this one overcomes with impunity and without the least discomfort, the perilous step where that one loses his health and sometimes his life.

From where can this seemingly inexplicable difference arise?

The subjects, little nervous, little impressionable, little ticklish, if I may express myself thus, are generally sheltered from attacks of the pruritus of teeth-

ing. The constitutions of an opposing nature are, on the contrary, prey to that which attacks it and holds fast with tenacity. It is amongst them that you frequently see it provoke the most violent crises, without its action nevertheless producing appreciable disorders in the organism. In fact, Mr. Guersant has proved, by the anatomical study of the bodies of a large number of children dead from convulsions caused by teething, that there did not exist any lesion capable of justifying and of explaining such a fatal result.

I have said that, in the opinion of this professor, the ills of the first dentition issue from the *dental irritation*. M. Trousseau, on his side, finds the source of it in a *purely nervous disturbance*. In view of the opinion of these scholars, corroborated by that of Messieurs Blanche, Barthez, Rilliet, Roger, Barrier, Duval, Deschamps, Duvivier, and of a great number of other distinguished practitioners, it was of chief interest: firstly to fathom the cause of this *nervous disturbance*, this *dental irritation* which no one has yet explained in a precise and categorical manner. Secondly, to find a way to combat directly this cause which carries the disorder into the economy and upsets so seriously the health of the children.*

In describing the Pruritus of Dentition I have satisfied the first condition.

In pointing out the way** of maintaining the gums of nurslings in a perfect state of health and of bloom at the time of the cutting of the teeth, and consequently of resisting the development of this fatal pruritus, I am confident of having fulfilled an important gap in that which concerns the hygienic cares with which children at the breast must be surrounded.

209 E. 23rd St.,
New York 10, N. Y.

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* It is necessary to fight the causes of the illness and not the illnesses themselves, under pain of failure. Thus, let an individual plunge a thorn into his foot, let the fever break out, is it necessary to take care of the fever? Obviously no! In removing the thorn, all medication becomes superfluous, the fever stops.

** The hygienic syrup with which you must rub the gums of the children during the course of the teething, is found today in all the pharmacies, and especially at the Beral pharmacy 14, rue de la Paix in Paris.

Abstracts

THUMB AND FINGER SUCKING; A STUDY OF 2,650 INFANTS AND CHILDREN. Traisman, A. S. and Traisman, H. S. J. Pediatrics, 52:566-72, May 1958.

The Drs. Traisman, who are physicians, studied 2,650 patients in consecutive order. All were white and ranged in age from birth to 16 years of age. A dietary history was taken from the mothers who had been urged to keep written records. All infants were on demand feeding for the first three months and records kept of the length of feedings.

Results:

1. 1,208 children were thumb suckers, or 45.6 per cent of the total group.

2. 300 infants or 11.3 per cent were breast fed to some extent. The average duration was 4.4 months. Only 130 or 43.3 per cent became finger suckers. Therefore breast feeding was not significant in the incidence of thumb sucking.

3. The majority took less than 30 minutes to feed. In the fast to average time feeding group, 41.7 to 45.8 per cent were thumb suckers. The higher incidence of thumb sucking or 62.7 per cent took place in the slow feeding group.

4. Malocclusions were diagnosed by Drs. Traisman and confirmed by an orthodontist. Of 211 patients who had malocclusion, 117 or 55.4 per cent sucked fingers. Amongst all thumb suckers, 9.7 per cent developed malocclusions as compared to 6.5 per cent of non thumb suckers. The authors stated that although there is a definite effect of thumb sucking and malocclusion, the degree of relationship is very small and of limited extent.

5. The authors also pointed out in the study that there was no statistical significance between thumb sucking and psychological problems and also "colicky" infants.

6. The average age at which thumb sucking stopped was 3.8 years.

It is the opinion of these doctors, that the more a baby sucks and gains oral stimulation and gratification, the more he is likely to suck fingers. They concluded, in agreement with others, that the thumbsucking problem has been over-emphasized and parents unduly alarmed. Parents, they said, should be informed and reassured about relative harmlessness of this habit. From this study, it would be incorrect to tell anxious parents that their child will stop the sucking habit by 1 or 2 years old.

HUGH M. KOPEL

SOME EFFECTS OF CAVITY INSTRUMENTATION ON THE ADAPTATION OF GOLD CASTINGS AND AMALGAM. G. T. Charbeneau, D.D.S. J. Pros. Den., May, 1958, Vol. 8, No. 3, P. 514.

Various rotating dental instruments produce wide range of roughness on cavity walls. The use of diamond instruments and cross-cut fissure burs for finishing a cavity produces irregularities which allow unsupported enamel rods to remain at the cavosurface margins. In seating castings in Ivorine preparations, the article demonstrated that the greater the roughness, the more the casting would remain unseated. The smoothness of the cavity wall was desirable. The smoothness of the casting appears to be a function of the investing material and casting technique rather than cavity wall finish.

Proper finishing is necessary prior to cementing. A gold possessing a low yield point and a high per cent of elongation without detriment to the other necessary physical properties demanded by the situation will permit the dentist to produce a more desirable adaptation. A cavity liner and cement will alter, to some degree, the previously obtained wall and marginal relations. Therefore it becomes necessary to have proper margination at the time of cementing before the cement becomes sufficiently set to form a layer between the casting and the tooth tissue. Such a layer of cement will dissolve and leave an open margin.

M. M. ALBUM

THE ROLE OF OPERATIVE DENTISTRY IN THE NEXT DECADE. W. J. Simon, D.D.S. J. Pros. Den., May 1958, Vol. 8, No. 3, P. 509.

The author believes that all individuals performing operative dentistry have a common root—the eradication of dental decay. The operative dentist has carried the torch for those individuals who delve into research patterns of a preventive for dental decay. The trend of exploitation of the past 10 years in the field of preventive dental decay continues into the next decade, "an open revolt, which is slowly brewing will burst into conflagration." Dr. Simon feels that dentistry has struggled too long to see its efforts eaten away by facetious advertising claims.

The three periods in which dentistry has travelled can be summed up as the radical or surgical period, the restorative period, and today we have the preventive period. It is within the heart of all dentists to hope for the resolution of dental caries. Environment plays an important role in the maintenance of the continuity of the enamel of our teeth.

The use of chemicals, drugs, and antibiotics, ammoniated compounds and penicillin according to Dr. Simon demonstrate how little is actually known of the flora of the oral cavity. He hopes that the next decade will bring forth a definite correlation of the well-being of the teeth with the host of physical, chemical, and biologic phenomena now at loose ends in the spectrum of present day knowledge.

It is felt that the evidence is irrefutable that genetic backgrounds influence size, shape, arrangements, and quality of teeth. The facts associating genetics with dental caries are not to be dismissed lightly.

The development of new instruments and new filling materials has not occurred by revolution. The use of high speeds of low torque, the author mentions, is not new to industries such as the jewelry and stonecutting trades. He feels that perhaps dentistry has waited so long to accept this departure from the routine, because of the need for a wet field of operation. There still exists a group of dentists who carry out the debate of a wet field versus a dry field and high speed versus low speed. According to the article, less happens to the pulp when using high speeds than when the tooth is dessicated under a rubber dam and the dentin is overheated with steel burs. Progress in operative dentistry during the next 10 years will be dependent upon the courage of teachers in the dental schools who have the fortitude to stand up and practice humane dental surgery on the teeth and apply simple biologic procedures of tolerance for the pulp.

The evacuating system for the removal of the coolant, saliva and debris

as well as the air turbine handpiece with the atomized water spray are several refinements.

The question also raised in the article is whether the cuspidor will be essential to a dental practice as well as the use of a belt driven engine handpiece.

Filling materials have changed in the last 10 years and do not resemble their crude predecessors. The next decade may see the development of a product with the same coefficient of expansion and contraction as enamel itself.

With the conclusion of World War II, the possibility of newer concepts of dental practice arise and the one-man office may be no more. The need for more dental schools will arise as well as the upgrading of students studying dentistry today by better medical dental relationships. Ancillary help can help the dentist double and triple the amount of service given to the public.

The author concludes by saying that in the next decade the operative dentist will come to appreciate his skill as a specialist in the surgical treatment of dental disease and what has been described as, "bread and butter drudgery," will rise to its rightful heritage as the specialty of specialties.

M. M. A.

DYNAMICS OF ORAL DIAGNOSIS. E. Cheraskin, A.B., M.A., M.D., D.M.D. and L. L. Langley, A.B., M.A, Ph.D. Jr. of Amer. Soc. of Psychosomatic Dentistry. Jan. 1958, Vol. 5, No. 1, P. 14.

The authors feel that a diagnostician must ferret out clues as assiduously as a detective in making a diagnosis. Sometimes it is possible to make a diagnosis with comparative ease, other times it is necessary not only to observe the gait, hands, stature and detailed history of the patient, but also to observe the patient's personality. This last important aspect associated with the patient is often passed over by the diagnostician.

One concedes that disorders in the psyche produce derangements in the oral structures and that changes in the oral tissues may seriously influence the emotional state of the individual.

The article points out that changes in the psyche produce alterations in the cardiovascular system, in glandular activity, and in the musculoskeletal system. Individuals under emotional duress show a reduction in local nutrition to the periodontal tissues as a result of vascular changes in the area. Atrophy, recession, and ischemia are often associated with depressed states. Chronic psychic hyperactivity may result in gingival bleeding, edema, and marked engorgement of the gingiva.

Pernicious habits of fingernail, pencil, and tongue-biting develop under emotional tension. The insertion of fingers and foreign objects according to psychiatric evidence represent a break-through of instinctive desires which are concerned with normal infantile pleasures. In the grown child they represent a form of regression. Emotionally disturbed individuals exhibit bruxism or clenching of the teeth.

The emotionally disturbed person presents all types of taste perversions with respect to foods. The result being an increase of sugar and acid and subsequent dental caries.

The authors firmly believe that missing and malposed teeth, cleft lip and cleft palate contribute seriously to personality alterations. These people may become withdrawn, anxious, and even suicidal.

The study of the individual's psycho-

physical structure has been termed constitutional psychology. This is actually a science dating back to the time of Hippocrates. With a modern approach to this science, the authors have classified people into three categories; endomorphy and viscerotonia, mesomorphy and somatotonia, and ectomorphy and cerebrotonia.

M. M. A.

Space Maintenance*

David B. Law, D.D.S., M.S.

I. Introduction

One of the important services that the general dentist and pedodontist can render for young patients is that of maintaining arch length prior to the eruption of the permanent teeth. This service is clearly the responsibility of any dentist who sees children. Our whole philosophy of prevention of loss of teeth in the childhood years is to a great extent based on this need for preserving room for the permanent dentition. Most of us will agree that there are few exceptions to the statement that space should be maintained in all cases of premature loss of primary molars and young permanent molars and incisors. The premature loss of primary incisors is usually not accompanied by over-all loss in inter-canine arch length and usually does not require space maintenance. Exceptions to this general rule may occur when unusual muscle pressures exist, or when an appliance is desired to prevent development of a tongue habit.

II. Etiology of Space Closure

We know that mesial drift of posterior teeth is nature's mechanism for closing contacts and compensating for interproximal wear. What, specifically, however, is the reason for space closure and loss of arch length where the primary first or second molar is prematurely extracted? The answer to this question has not been established on a truly scientific basis, although, there are some very strong arguments in favor of certain contributing factors.

1. The inclination of the long axis of the permanent molars in the dental arch. If two teeth contact each other in closure and each tooth is inclined in a mesial direction, there will be created a mesial component of force which will tend to tip these teeth further and which will transmit a mesial force to the contacting adjacent tooth. This factor is more significant in the permanent dentition than in the primary where the molars are in a more nearly vertical position.

2. Path of least resistance. It is a matter of clinical observation that teeth tend to move in the direction of the path of least resistance such as is created by the loss of bone from extraction of an adjacent tooth or in the case where bone is uncovered deliberately and maintained in that condition.

3. Influence of buccal musculature. The wrapping action of the buccinator muscle from its posterior attachment to the pterygo-mandibular raphe around to the orbicularis oris group may in some individuals exert a mesial force on the posterior teeth.

4. Effect of position of the center of rotation of the mandible. Smyd[1] has pointed out that the more the axis of mandibular rotation is lowered in respect to the occlusal plane of the teeth the less the amount of horizontal anterior thrust transmitted to the teeth in occluding. It is interesting that on this basis alone, the amount of anterior thrust in a given

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* Presented at Panel Discussion "Practical Approach to Preventive Orthodontics," Annual Meeting, Miami Beach, 1957.

mouth is less if we proceed from third molar to cuspid. It is also true that in the first three years of life, when the height of the ramus has not yet caught up with the increase in length in the body of the mandible, inter-dental spaces in the primary molars are common. Whether or not these spaces close up in the fifth and sixth year as a result of an increase in the height of the axis of mandibular rotation or whether it is a result of erupting mesial pressure of the first permanent molars is not known. It is possible that all four of the factors that I have described occur to a greater or lesser degree in a given set of circumstances.

Various studies have indicated that not all spaces created by the early loss of primary molars necessarily close.[2, 3] However, a large enough percentage will do so and from a practical viewpoint, it is better to assume that posterior spaces will close and take no chances. The theory of watching all spaces and seeing if they will close reminds me of a story of a farmer who came to town and decided to go in the saloon and have a beer. He tied his team of horses to the hitching post and asked one of the loafers to keep an eye on them for him. When he came out a little later the team was gone. He asked the loafer why he hadn't watched them for him as he requested. The man responded that he had, "he had watched them run away." Space closure in the anterior part of the mouth in the permanent dentition is probably usually due to drifting in the direction of the path of least resistance. There have been many arguments concerning whether or not it is necessary to concern ourselves with the premature loss of the primary incisors. It is well known that in a normal primary dentition these incisors are not in contact and are spaced. It is common observation that they maintain their space and show no tendency to close together. Cases have been described to me by various dentists with alleged space closure after premature loss of primary incisors. In these cases, where models are available, it can be usually shown that there has been some drifting of primary incisors due to loss of bone created by extraction but that the total inter-canine width has not been shortened. These then are the problems with which we have to deal. I would like to ask a question. Are there any *contraindications* for space maintenance in the premature loss of primary molars or permanent molars or incisors? The answer in general is no. One can hardly go wrong by constantly maintaining existing arch length. However, there are some exceptions and these will be discussed.

Cases are occasionally seen where a second primary molar is lost during the preschool years and no evidence of formation of a second bicuspid is evident in the roentgenogram. It has been suggested that in such a case space retention is not advisable, and that extraction of the second primary molar on the opposite side is the treatment of choice, allowing the lower permanent molars to drift forward. It is unwise to make a final decision concerning the true absence of a bicuspid prior to the age of 7 or 8, and at this age bodily movement of the permanent molars is a remote possibility.

In a recent case discovered in routine observation in our clinic, a boy aged 9 showed extensive development of crowns of upper and lower bicuspids, although full mouth roentgenograms at the age of 7 showed no signs of second bicuspid germs or beginning calcification.

In the event that a definite diagnosis is eventually made concerning missing bicuspids the decision for space maintenance will depend on whether or not we are dealing with a normal occlusion with adequate arch length or whether it is a crowded arch which would ordinarily be handled by an orthodontist as a 4 bicuspid extraction case. If it is an otherwise normal occlusion, space maintenance and eventual fixed bridgework would be indicated. If it is already a case of insufficient arch length space maintenance would be a superfluous procedure and the proper treatment would be bilateral closure by orthodontic means. Occasionally we see a situation in which a primary molar is prematurely lost in the mixed dentition but in a mouth where there is lots of room, even some spacing evident in the posterior region, and where the first permanent molars are in normal occlusion with good cuspal interdigitation. Such a situation might justify a policy of non-interference and close periodic observation. It should be emphasized that if there is any doubt in the mind of the general practitioner or pedodontist concerning these borderline cases of space maintenance the consultation of an orthodontist should be sought.

III. Methods of Space Maintenance

The best space maintainer is the intact natural tooth itself. It should not be necessary to point out that it is hopeless to expect broken down crowns of carious primary teeth to serve as adequate space maintainers. The efforts directed toward conservation of the primary tooth until normal exfoliation are well worth the effort expended by the dentist. Even in the highly caries susceptible child, much can be done to control rampant caries thru frequent and periodic examinations, patient education and sugar restriction, teaching of oral hygiene and by the use of topical fluoride therapy. Good operative dentistry plus intelligent pulp therapy will save many teeth which now are needlessly sacrificed. Where all else has failed and the tooth must be extracted, a decision must be made as to the type of space maintaining appliance to utilize. There is some discussion as to how soon a space maintainer needs to be inserted after the loss of a primary molar. In case of the premature loss of the first primary molar, in the mixed dentition period, assuming an uncrowded anterior segment exists, if the root of the first bicuspid is ½ to ⅔ developed and the crown is not covered by bone and if the second primary molar has not undergone more than ⅓ root resorption, I would be inclined to favor watching the space for a period of 4 to 6 months without appliance therapy. However, if crowding already exists in the anterior segment of the arch, observation only is contraindicated and a suitable appliance should be inserted immediately. If not done, there will be distal shifting of the anteriors toward that side, and possible blocking out of the 2nd bicuspid, needlessly complicating later treatment. If the second primary molar is lost prematurely, I would place a space maintainer immediately. The first permanent molar can tip mesially in 6 weeks to 2 months time in some mouths. In case of loss of permanent incisors I would place a space maintainer immediately because of the rapidity with which the adjacent teeth may drift. Selection of the particular type of appliance to be used in a given case may vary somewhat according to the personal preferences of the dentist. In general, it is bet-

ter to use a fixed space retainer wherever practicable instead of a removable type. There is less dependence on patient cooperation and fewer adjustments with a fixed retainer.

Optional appliances, in order of preference, for cases indicated:

1. Unilateral loss of first primary molar in preschool years.

1. Cast overlay or crown on second primary molar with bar to primary cuspid. 2. Steel crown with soldered stainless steel loop to primary cuspid. 3. Orthodontic band with wire loop to primary cuspid. 4. Stainless wire imbedded in approximating amalgam restorations on mesial of second primary molar and the distal of primary cuspid.

2. Bilateral loss of first primary molar in the preschool years.

1. Two of the appliances described in (1) above may be used. 2. A removable type of acrylic partial denture with wire clasps or a cast cobalt-chromium type of alloy partial might be used.

3. Unilateral or bilateral loss of first primary molars during the mixed dentition period.

1. The appliance of choice is a lingual arch with bands on the first permanent molars. 2. An acrylic or cobalt chromium alloy partial may be used. 3. If the primary cuspid has adequate root one of the appliances described under section 1 above might be used.

4. Unilateral loss of second primary molars in preschool period, prior to eruption of first permanent molar.

1. Cast gold crowns or overlays on primary cuspids and primary molars with a distal extension into the gingival tissue to guide the unerupted first permanent molar into proper eruption. 2. Cast crown or overlay on first primary molar only with cast bar or distal extension into gingival tissue. 3. Steel crown with wire loop extending distally into the gingival tissue.

5. Bilateral loss of second primary molars prior to eruption of first permanent molar.

1. Partial denture of cobalt chromium alloy or acrylic resin terminated at distal of missing primary second molar and beaded on tissue side to resist forward movement of permanent molar. 2. Two separate appliances of the type described in preceding paragraph.

6. Unilateral or bilateral loss of first and second primary molars in preschool period.

1. The ideal appliance would be a partial denture of cobalt chromium alloy with plastic teeth to supply function and guide first permanent molars into occlusion. 2. A plastic partial denture with wire clasps is the next of choice. Such appliances need to be accurately terminated at the distal and beaded on the tissue side to resist forward movement of the permanent molars. 3. Cast crowns on both primary cuspids connected with a soldered lingual bar with distal extension into the tissue overlying the first permanent molar.

7. Unilateral loss of second primary molar in mixed dentition period.

1. Fixed lingual arch with orthodontic bands on first permanent molars. 2. Orthodontic band on first permanent molar with wire loop to first primary molar. 3. Steel crown or cast overlay on first primary molar with extension contacting mesial of first permanent molar.

8. Bilateral loss of second primary molar during mixed dentition period.

1. Fixed lingual arch, orthodontic bands on first permanent molars. 2. Acrylic resin partial denture with clasps on first primary molar and occlusal rest on permanent molar. 3. Two separate appliances of the type described in preceding paragraph.

9. Loss of one or more permanent maxillary incisors.

1. Cobalt chromium alloy or acrylic resin partial denture with crib type clasps extending over contact of first permanent molar and second primary molar with plastic teeth supplying missing units.

IV. Discussion

In general, a fixed appliance is more satisfactory than a removable one, although it may be initially somewhat more expensive to construct. The fixed lingual arch type of appliance should be used more extensively. It has excellent anchorage in the lower arch if properly constructed so as to contact the cingulums of the lower incisors, and it is not dependent on any single primary tooth. It can be used in the maxillary arch if a small plug of acrylic resin is adapted to the anterior section to contact the hard palate.

(Any banded appliance should be removed at least once a year and recemented, to prevent any possibility of a leaky band remaining undiscovered and causing enamel decalcification.)

Many dentists experience difficulty in controlling moisture during the cementation of a lingual arch. One orthodontist[4] has suggested that an effective and safe means of controlling this salivation is to administer 50 mg. of Banthene, an atropine-like drug, half an hour before the appointment. The drug is safe to use, has no deleterious side reactions, and greatly reduces the salivary flow for a short period.

In considering the use of removable type of space maintainers patient cooperation must be evaluated. Where there is a history of loss and breakage of such appliances during school hours and at play, the feasibility of wearing the appliance only at night should be explored. This is especially applicable during the mixed dentition period, when the first permanent molars are erupted, and the wearing of the appliance at night is under close parental supervision. Space can be effectively maintained under such a program although it would not be advisable for a preschooler where the first permanent molar is unerupted.

V. Conclusion

A variety of physiological factors are responsible for the migration of teeth in the dental arch. It is the responsibility of the dentist who sees children in his practice to utilize the best available techniques to maintain arch length. Different appliances may be equally successful in accomplishing the desired objective, but in any case there is no substitute for careful and periodic observation of the patient.

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The Role of Children's Dentistry in the Next Decade

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History of Yesterday for the Tomorrow. Perhaps a brief return to the past events in dentistry, of the last decade, may give us some direction as to the potential patterns for tomorrow. There has been considerable favorable maturation of this embryo, which may be referred to as dentistry for children or pedodontics, in the profession and in dental education, during the decade since World War II, and in reality since 1940. It was back in the dark ages of 1940, some 100 years after the organization of the first School of Dentistry in the United States, that a Committee from the American Society of Dentistry for Children pleaded with the Council on Dental Education to set forth a statement which would require dental schools to include dentistry for children in the curriculum of approved schools. The Council on Dental Education did establish such a requirement following the Houston, Texas, meeting in 1940. This decision on the part of the Council on Dental Education has had a most favorable impact upon the teaching and practice of dentistry, and in effect it has marked a new era in dentistry.

The spark that ignited the "flame of dentistry for children" in this country was a small group of dentists who organized the American Society of Dentistry for Children in Detroit in 1927.[1] Thirteen years later in 1940 this pioneering organization was still struggling to establish a firm foothold in American dentistry against great odds in dental education and in the profession. In addition to the favorable decision by the Council on Dental Education in 1940, the American Society of Dentistry for Children continued to press for recognition to permit the organization of the American Board of Pedodontics. It was believed by the A.S.D.C., that there was an adequate body of scientific knowledge, and that there were required skills beyond the level of undergraduate education and training in dentistry, to warrant the recognition of Pedodontics as a specialty in dentistry. Accordingly, the A.S.D.C. sponsored the organization of the American Board of Pedodontics, which was incorporated in 1942.[2] The war years provided a further maturation of the field of pedodontics, as well as other specialty areas in dentistry, and it was in 1947 that pedodontics was recognized as a specialty by the House of Delegates of the American Dental Association, and the American Board of Pedodontics subsequently was given official status by the Council on Dental Education.[3]

About this same time, a decade ago, another very important organization was incorporated, namely, the American Academy of Pedodontics, which had its first annual meeting in 1948.[4] While the American Society of Dentistry for Children invites into membership all members of the American Dental Association who are interested in dentistry for children, including general practitioners and any members of the specialty groups, the American Academy of Pedodontics

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has a membership restricted to those dentists limiting their practice or teaching to pedodontics. The A.S.D.C. now has an enthusiastic membership of more than 4,500,[5] while the Academy has more than 100 members.

Some ten years ago, shortly after the close of World War II, this writer included the following statement in the preface of the second edition of his book "Dentistry for Children."

> "Forces far greater in scope than the minority in the profession who have carried the banner of dentistry for children are active, and these forces progressively will place pedodontics in its proper perspective in the curriculum of the dental schools and in practice. The forces have expressed themselves in the demonstration of the need for the preservation of human as well as national economy, and they have emanated through various channels, such as: legislative proposals in Congress to effect a more universal health service, military directives and activities in the dental reconditioning of millions of men, and the change of attitude in the profession with regard to a national dental health program."

The prediction and observations cited in the latter quotation, written in 1947, are interesting and significant when one evaluates the present day development, scope and pattern of teaching and practice of dentistry. Without question, dentistry for children has received more attention and encouragement from the profession, dental schools, public schools, and governmental agencies during the past decade than has any other phase or area of dentistry. Accordingly, the dividends, in terms of a greater health service to people everywhere, have been real and tremendous in scope.

Present Day Development and Problems of Dentistry for Children. Today's standards of teaching and practice in dentistry are the fruits of yesterday's thinking, planning and achievements on the part of the profession, coupled with the influences of the varied forces within the total social and economic structure of the people of the country. Likewise, the standard and patterns of practice, including dentistry for children, to be realized five, ten and twenty years hence are unfolding each day through creative thinking, research, development of additional centers of learning, and common effort involving the varied economic and social interests. While it may be professionally polite and perhaps momentarily expedient to state that the dental profession is setting the standards of service which the children and adults will receive in the tomorrow, one cannot deny that economic trends, Federal and State legislative programs, population increases, level of public education, benefits afforded by unions, and possible insurance programs will have a marked influence on the types and the quantity of dental services to be rendered. The alert profession, dental society, and practitioner will keep informed and in tune with the realities of a dynamic social structure, and, furthermore, assist in guiding the forces to permit the finest possible health service.

Present Status of Teaching and Practice. Every school of dentistry now provides an undergraduate teaching program in dentistry for children. Unfortunately, there are some schools remaining which are understaffed due to an inadequate budget, with the result that

many graduates of such schools are not prepared to render an acceptable service to the child patients. However, there has been a tremendous improvement in the quality and quantity of instruction during the past decade. Encouraging, too, is the increase in the number of schools now offering graduate instruction in pedodontics, not only for the preparation of specialists for private practice, but, also, providing an excellent source of teachers as well as background for productive research. Postgraduate or continuing educational courses offered by most schools of dentistry as well as excellent programs at the national, state and local dental society meetings, also have had a most favorable influence on many practitioners.

Unfortunately, to date the large majority of the state examining boards have not found it desirable to require a candidate to show proficiency in clinical dentistry for children. This void in the examinations of the state boards has the unfortunate effect of "stating to the candidate and accordingly to all dentistry," that dentistry for children is relatively unimportant. The state boards could have a very favorable influence upon the teaching in dental schools and upon the profession at large, if official cognizance were given to pedodontics by requiring one or more child patients in their clinical and diagnostic examinations. The state boards in reality cannot avoid this responsibility for the best interests of the people of the country and the profession.

Population Trends. The total population of the continental United States in 1940 was listed as 131,699,275, and by 1950 a 14.4 per cent increase was evident with a figure of 150,697,361. It is estimated by 1960 there will be a total of 177,840,000 (U.S. Bureau of Census, 1955). Presenting the data in another way, there are some 11,200 new Americans born every day, about 500 people added by migration, and approximately 4,300 die. This represents a net gain of some 7,400 per day in the population of the United States, or about two and one-half million per year (Kirk, 1956).[6]

Another interesting and significant group of data show that in 1940 there were 10,684,622 children between the ages of five and nine in the United States, while in 1950 this number had increased to 13,199,685. It is estimated that by 1960 this number will have reached 19,152,000 (Manpower and Education, 1956).[7] This phenomenal national growth in reality means dentistry, in addition to the training of more dentists and auxiliary personnel, must give further emphasis and direction to research and to the teaching and practice of prevention on a community level as well as in the private office. It means further that every resource at dentistry's command must be directed to the children of this country to eliminate the inevitable accumulated needs as evidenced by neglect (Pelton, 1955).[8]

Dental Needs. Limited data are available on the prevalence of dental caries among preschool children, or in the primary dentition at a later age (Fulton, 1952,[9] and Pelton, 1955). Fulton, in a report of some 3,000 children examined by the Division of Dental Health of the Illinois Department of Health ranging in age from one month to 71 months of age, listed the following def teeth* rates per child:

* def teeth refers to decayed, extracted (missing), and filled primary teeth, while DMF refers to decayed, missing, and filled permanent teeth.

0.02 at 18 months; 0.22 at 30 months; 1.06 at 42 months; 2.82 at 54 months; and 4.07 at 66 months.

McCall (1938) stated that about 50 per cent of the children at two years of age examined at the Murray and Leonie Guggenheim Dental Clinic had one or more decayed primary teeth.[10] He also said (1941) that more than 30 per cent of the two-year-old patients had seven or more cavities, and that nearly one out of every four children at this age required at least one extraction.[11] Sixty per cent of the five-year-old children examined had seven or more teeth with cavities and one or more teeth which needed extraction.

Moen (1953), in a survey of the needs for dental care of some 37,911 white patients in an age distribution from 4 to 70 years, listed children of four years of age requiring three teeth to be filled and about 0.30 teeth be extracted. The five to nine-year old group required about 3.40 teeth to be filled and 0.86 to be extracted.[12]

Cohen and Massler (1952), in a report of a dental examination of 180,000 grade and high school children of Philadelphia, made by the Dental Service of the Medical Division of the Board of Public Education, listed the following def and DMF rates: 2.8 def and 0.37 DMF teeth at age six; 3.5 def and 0.83 DMF teeth at age seven; 3.2 def and 1.8 DMF teeth at age eight; 3.1 def and 2.2 DMF teeth at age nine; and 1.9 def and 2.9 DMF teeth at age ten.[13]

It is estimated by Klein (1944), of the United States Public Health Service, that the average individual between the ages of 6 and 20 will require about one filling each year, and that the accumulated needs of this age group is about seven fillings per person.[14] He further said that the dental needs developed at nearly the same rate regardless of the socio-economic status of the various segments of the population, and that children received only about one-fifth of the fillings actually required. The average permanent tooth mortality, according to Klein (1943), is about 0.03 at the age of seven, 0.29 at the age of ten, and 1.07 at the age of fifteen.

Pelton (1955), in referring to the Richmond, Indiana, study, shows a DMF increment of somewhat more than one tooth per child per year over a ten-year period (ages 5 to 15), and that by the age of 15 years more than one-third of the permanent dentition already showed evidence of dental disease. The average need for extractions increases with age, varying from an average of about one-half a tooth per child under ten years of age, to a value between two and three per person for age levels above 50.[8]

Massler (1945) indicates that the teen-age is a period in life which exhibits the greatest susceptibility to dental caries. This means that an intensive dental health educational program is essential during the individual's entire preschool and school career, and that the high-school age level is no exception. He states that the average individual from 5 to 20 years of age can expect to acquire about 1.3 new cavities per year.[15]

Dental disease is cumulative and becomes increasingly complex through neglect. Accordingly, systematic dental treatment to correct dental defects as they arise among school children is one of the important goals in public health dentistry (Pelton, 1955).[8] The great group of 10,500,000 children under five years of age presents a tremendous chal-

lenge to American dentistry. If the dentist now could give this preschool group complete dental treatment with subsequent routine dental service, and then each year add to this number the two or more million children who annually become two years of age, few dental cripples would be evident at the age of 20 or 30 or in the years beyond. The dental "have nots" always will be with this nation unless some comparable program is initiated, or unless dental caries and infection can be eliminated through preventive measures other than operative procedures.

The data submitted in the previous paragraphs are examples of findings related to the incidence of dental caries and dental needs at the time of the study. No one can predict accurately the dental needs for the preschool, school, and young adults of military age of tomorrow. Unfortunately, there is little evidence to warrant a conclusion that the attack rate of dental caries or periodontal disease has been reduced in this generation, except for dental caries in communities where an optimum fluoride content was evident in the water supply (Ast, 1955[16] and Dean, 1956[17]). However, there is acceptable and well-qualified evidence that dental caries and periodontal diseases can be controlled in a large percentage of cases (with measures other than fluorides for dental caries) providing the patient is cooperative. The Michigan Workshop (1948)[18] considering the problems related to the etiology and control of dental caries, the symposium on "Sugar and Dental Caries" in California (1950),[19] Robinson and Kerr (1948),[20] and others in their discussions with reference to periodontal diseases, present adequate data to indicate that a significant reduction in the total dental needs may be realized through control procedures. The number of dentists and auxiliary personnel which would be required to make available an adequate dental service for the people of any community or state or the nation, if comprehensive preventive and control practices were instituted in all homes and in all communities, is not known. From past experience, however, one can predict that only a small percentage of families will impose upon themselves restrictions in food and other disciplines related to nutritional requirements and oral prophylactic measures.

In addition to the dental needs for the so-called well or normal child, there is a great opportunity for service in the care and treatment of the handicapped child. Parents with children having cerebral palsy, mental, or other physical problems have experienced considerable difficulty in finding dentists who are prepared to do restorative dentistry or other services for this type of patient. While many of these patients can be treated successfully in the private office, hospitalization is desirable and essential in some cases (Lindahl, 1956;[21] Castaldi, 1956;[22] Weisman, 1956;[23] Koster, 1956[24]).

Wessels (1956) points out that the physically or mentally handicapped child in general has been neglected socially, educationally, and physically. He emphasizes the importance of treating dental disease in its incipiency, and that the handicapped child should be examined by a dentist by the age of three years. Wessels states, "Dental decay and gingival disorders are usually of greater intensity and more widespread involvement in the affected child because of neglect, as well as the difficulties attending achievement of satisfactory oral hygiene by the child.[25]

Demand for Dental Service. The dental needs of an individual family, or community, do not determine the demand for dental service. The dental needs of a family generally are far greater than the demand. There are a number of factors which influence the demand for dental services, including: the level of dental health education of the parents and children, the economic condition of the family or individual, the availability of dentists in the community or area, emergency needs of the patients, the fluoridation of communal water supplies, and fear of the pain. The latter cited factors, which are not listed in order of importance, vary with individuals.

The Bureau of Economic Research and Statistics (Moen, 1954), in a family dental survey involving 8,320 family members, found that about three-fourths of all children under five years of age, and nearly one-fourth of all children in the age group five to nine, had never been to a dentist.[26] This survey would indicate that the need for dental health education of parents with preschool children is great. The decision as to whether the child will receive routine dental examinations and treatment rests with the parent. Unfortunately, the latter statement is not always true, since some dental practitioners give little, if any, dental service for children.

The level of education, involving the same 8,320 family members or some 2,443 families, is expressed further in their replies to questions which follow. "A toothache does not necessarily require the attention of a dentist since it will often disappear by itself." About one-fourth, 24.7 per cent, replied "yes" to this question. It is interesting to note that 82.8 per cent indicated "yes" to the question, "Primary (baby) teeth which have decayed usually should be filled even though they will be replaced by permanent teeth later." Then, 39.0 per cent indicated "yes" to the question, "The six-year molars are eventually replaced by permanent teeth."[27]

In another survey of public school dental programs, wherein questionnaires were sent to superintendents in 3,529 cities of more than 2,500 population throughout the United States, it was revealed that 91.5 per cent of the schools excused the children during the day to go to the dentist.[28] Only 4.3 per cent answered "no," and 4.2 per cent stated children were excused only in emergencies or when the child was in pain. It is believed that the schools answering "no," in reality, did permit the child to go to the dentist in an emergency. This survey (Moen, 1955) reflects a most encouraging sign, in that the schools give recognition to this important health need.

Another area of interest, which may have an increasing influence on the demand for dental service, is the dental health and treatment programs for children sponsored by the International Longshoremen's and Warehousemen's Union and the Pacific Maritime Association. Other types of programs, such as, "Group Dental Health Insurance", also are being evaluated (Miller, 1956).[29] The latter type programs afford both educational and economic support, and thereby they would motivate a larger percentage of families to seek regular dental service.

Dental Manpower. The population trends, reflecting a marked annual increase, warrant most serious consideration with respect to availability and adequacy of dental care for this and future

generations. Pelton (1955)[8] indicated that there were only about fifty dentists for every 100,000 civilians in 1952, as compared with approximately fifty-three in 1940.

Moen (1956), Director, Bureau of Economic Research and Statistics of the American Dental Association, in evaluating the population potentials in the coming years, with the number of dentists now in practice and the number of dental graduates in the foreseeable future, presents the many variables related to adequacy of dental manpower.[30] Puerto Rico in July 1956 was listed with a population of 2,256,000, with 305 dentists, or a ratio of 7397:1.[31]

It should be stated that the true need for dentists in terms of numbers is a relative thing, since there can be no fixed or firm prediction of the many factors affecting dental manpower needs. A list of the important factors should include: (1) the state of dental health of the population, which would be affected to a large degree by the preventive measures employed on an individual and collective basis, (2) the effective use of dental assistants and other auxiliary personnel, and (3) the demand for dental treatment.

The value of the effective use of dental assistants cannot be over-estimated in determining and solving the dental manpower problem from an economical and practical point of view. The 1953 survey of dental practice (Moen, 1953) indicates that 26.9 per cent of the dentists employed no auxiliary personnel in their offices, that 41.2 per cent used one dental assistant, and that only 3.4 per cent employed two assistants.[32] Moen (1950) also found that dentists who employed one assistant averaged 37 per cent more patients than those without such employees, and that dentists employing two assistants averaged 69 per cent more patients.[33] Coomer (1956),[34] Pelton (1952),[35] and Waterman (1952),[36] all strongly support the thesis, that the effective utilization of dental assistants can bring about a substantial increase in dental services to patients. It is through this latter medium of operational economy that additional dental services can be made available to the children of every community.

The 1956 American Dental Directory lists only 151 pedodontists in the United States in 1955, as compared to 30 specialists in Public Health Dentistry, and 1,637 in orthodontics. There were only 3,098 dentists classified as specialists in all categories.[37] This means in reality that the general practitioner must continue to assume the responsibilty for the treatment of children, except in a few centers of population where the pedodontist may be located.

Predictions for the Next Decade. Assuming that one has had the privilege of being an active participant in the profession during the past 10, 20 or more years, particularly in the practice, teaching, and developmental phases of the subject under discussion, there perhaps may be some justification for an attempt to predict the role of children's dentistry in the next decade. If one examines and evaluates the changes and advancements during the past decade in the literature, educational programs in the dental and other professional schools, health education via public health and other programs, general education, the trends in private practice and in the several dental specialties, and the pattern of development of the various dental organizations including their programs, it is possible

to speak with some assurance about the future.

The Literature. The body of scientific knowledge, as expressed in the dental literature on the subject of dentistry for children or pedodontics, has increased immeasurably during the past decade. The scope of pedodontics was recently redefined by the American Board of Pedodontics, and this definition reads as follows: The practice or teaching of pedodontics implies the limitation of treatment to patients possessing a developing dentition (primary, mixed and young permanent). Such practice includes the use of pedodontic appliances to prevent or intercept malocclusions.[38]

Considering the present day scope of pedodontics, closely allied with orthodontics in problems related to the growth and developmental phases of the head, jaws and teeth, with a particular interest and responsibility in preventive orthodontics, with all of the attending problems and procedures related to cavity preparation, pulp and root canal therapy, the fractured central incisors, dentures, and surgery, significant scientific advancements have been made, and accordingly, presented in the literature. Many of the papers presented during the past several years at scientific meetings show evidence of well disciplined research in the several areas of interest in pedodontics. There also is evidence of more documented statements with fewer personal opinions, which identifies the scientific maturity and standards of a given field.

In addition to the scientific journals commonly recognized, the JOURNAL OF DENTISTRY FOR CHILDREN, published by the American Society of Dentistry for Children, has grown in stature as a result of publication of many original articles of scientific importance. Interesting and significant, too, is the list of books now identified by title with dentistry for children, with three in their first edition.[39, 40, 41, 42, 43, 44]

Considering the scope of dentistry for children, with the strong and active organizational efforts of societies in this field, with the increasing interest and demand for graduate instruction including research at this level, and the available funds for research by teachers and researchers, one can predict with considerable reliability that:

(1) the textbooks which will survive this next decade must be written with greater scientific accuracy and background than required in the past,

(2) fewer articles will be accepted by the editors of the better journals which are based primarily on personal experience, opinions, friendships, or politics, with the result that the scientific stature of dentistry for children and all dentistry will be enhanced, and

(3) the number of contributors to journals and books, who will have scientific backgrounds and research interests, will increase greatly.

Undergraduate and Graduate Instruction. The availability of a greater number of teachers, who have had graduate instruction and who have been disciplined in research, will without question increase the quality of instruction in all levels of dental education. The post-doctoral fellowships afforded by the U. S. Public Health Service, and other fellowship training programs, will have a most favorable influence in the programs of many dental schools.

Unfortunately, however, the number of dental schools now affording graduate work in pedodontics is still very limited, and the present demand for graduate

work in this area is appreciably less than in orthodontics. With the more adequate and enthusiastic instruction on the undergraduate level, and with the availability of short courses, a high percentage of the dentists limiting their practice to pedodontics today have elected to by-pass graduate work. While the American Board of Orthodontics still accepts candidates for examination who have had only preceptorship training, the American Board of Pedodontics does not look with favor upon this medium of training. However, the Council on Dental Education and the American Board of Pedodontics, do recognize some non-graduate programs.

The requirements set forth by the American Board of Pedodontics, consistent with those of the Council on Dental Education, has had a most favorable influence in establishing the standards for graduate work in schools of dentistry and for internships and residency programs in pedodontics. The requirements set forth by the American Board of Pedodontics, and accordingly, the graduate work in dental schools and other approved programs will continue to raise the standards of service in the coming decade.

One of the immediate problems relates to the lack of control of the specialties in the large majority of the states. For example, any dentist, except in those nine or ten states with laws controlling the dental specialties, can tomorrow list and call himself a specialist, or at least imply such by announcing his limitation of practice. Fortunately, many of the dentists who have elected to limit their practice in pedodontics, and in other specialty areas, have been fine students of the literature and have taken a number of short courses to improve their background. Furthermore, many of these latter cited individuals have made splendid contributions to the advancement of the field. However, this method of self-determination, as to their qualification for a given specialty, is not for the best interests of society. Accordingly, it is predicted that more and more states will establish legal standards in the control of all specialties in the coming decade. Assuming that the latter prediction becomes a reality, a greater responsibility will be placed on all dental schools to provide adequate graduate instruction, and, likewise, on all intern and residency programs.

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The Finger Sucking Habit and Associated Problems*

T. M. GRABER, D.D.S., M.S.D., PH.D.

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> Thumb and finger sucking are of importance because of the concern they cause in parents. The pediatrician to whom the alarmed parents come for advice is often as confused about the significance of the practice as are the parents themselves. He finds it difficult to help them or allay their fears. In order to do this successfully, he is in need of a working knowledge of the significance of the habit at different age levels. He needs to know what harm, if any, may result; what factors lead to the development of the habit, and what measures should, or should not be taken to handle the situation adequately.[1]

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FIG. 1. Typical thumb-sucking pose, showing distortion of nose and upper lip.

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factors occur in clusters. Briefly, this is our philosophy.

The First Three Years of Life

The creation of an euphoric state—a feeling of well being—is important in early life. Sucking appears to satisfy this need to a large extent. Pediatricians today emphasize the importance of adequate time for nursing. Spock writes in his newest edition that the once banned pacifier is again in good standing.[2] Gesell shows that the hand to mouth movement is just one of a series of infant akimbo movements, and is normal into the second and third year.[3] To advise a parent to break up this needed reflex-like mechanism during the time it is normal to expect such action ignores the basic physiology of infancy. Since homeostasis is a fundamental phenomenon of physiology, some infants will adapt to the restriction, sublimate their habit activities and apparently turn to other environmental satisfactions. But many don't and the habit is made more pronounced, so that it does not disappear autonomously as it would have, if left alone.

While we recognize the need for the habit during the first couple of years of life, it is difficult to accept the Freudian hypothesis of thumb-sucking and defecation as an expression of sexual gratification.[4] Inductive reasoning is an admirable didactic tool, but it remains for more objective research and the development of definitive criteria to lift this concept into the realm of fact.

Inductive reasoning and teleology are no firmer bases for claims by many psychologists that dire personality defects may result from attempts to break finger habits, even during the time it is normal to expect such habits. Claims of frustration, psychic trauma, habit transference, behavior problems, or at the very least, maladjustment, are frequent in the literature.[5, 6, 7, 8] In adult neuroses, the diagnoses that link infantile mannerisms with adult behavior have a most tenuous cause and effect relationship. Current trends in psychiatry deprecate the strong emphasis on retroactive reasoning and look to more likely etiologic elements. Hereditary predisposition looms increasingly larger as a major factor, with strong assists from home and work environments, motivations and relative success in our competitive society. Our study has not borne out claims of psychological disturbances as a result of placing interceptive appliances. Not a single case of habit transference has been documented, as yet.

Thumb and finger sucking habits, then, are considered a normal developmental facet for the first 2-3 years of life. It is felt that these habits disappear autonomously in most cases if left alone. This assumes that the home environment is a reasonably happy one—normal—if the word has any definitive meaning, and that the child is healthy and accepted by peers and elders. For the 0-3 year age group, our experience has shown that damage to the occlusion is confined largely to the anterior segments, and it is temporary, providing that there is a normal occlusion to start with. This is quite important, because there is much controversy over the possible damage that may result from finger and thumb-sucking habits. Because some of the damaging consequences of the habit are similar to the morphology conferred by a hereditary type Class II, Division I, malocclusion, the dentist has often been guilty of attributing Class II jaw relationships, excessive overbite and overjet

and bilaterally narrow dental arches to the habit history. In all likelihood, the configuration of the dental arches would have been the same, if there had been no habit history. In our experience again, children who discontinue the habit by the end of the third year of life seldom do more than increase the maxillary overjet, with concomitant spacing of incisor teeth in the maxillary arch, and a flattening of the mandibular anterior segment. Occasionally, a unilateral Class II relationship is seen that might be attributed to habit influence, but we do not have a single documented example of a normal occlusion being made into a full, bilateral, Class II by a finger sucking habit, regardless of the habit severity. Theoretically, such a situation would be possible, starting with an end-to-end buccal relationship, with the habit tipping the scales toward the Class II molar relationship. Such a case was not present in our sample.

Active Finger Sucking Habits After Three Years of Life

The majority of habits that continue beyond three years of life present clear case histories of parental and sibling at-

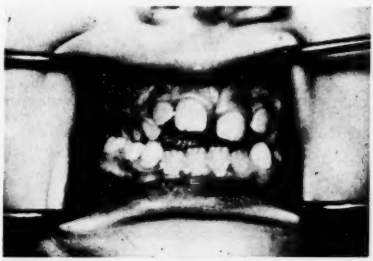

Fig. 2. Bilateral narrowing, unilateral crossbite and anterior open bite as a result of an active finger habit, with associated peri-oral muscular perversions.

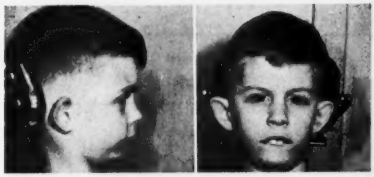

Fig. 3. Lower lip cushions to the lingual of the maxillary incisors, during rest and active function, increasing the already excessive overjet. (From Graber: Am. J. Orthodontics, September, 1956.)

tempts to stop the habit. In a large number of cases, the prolongation of the habit past the time it would normally be dropped can be laid directly at the doorstep of the family's ineffectual attempts to prevent thumb and finger sucking. There probably is a very good psychological reason for the fact that the father is most often the one most disturbed by the child's habit, and thus the one who calls attention to the activity constantly by admonishing or actual punishment. It is small wonder that these habits become a potent weapon in the child's attention-getting arsenal. The permanence of the deformation of the occlusion increases markedly in those children continuing the habit beyond three years of age (Fig. 2). This is not due entirely to the finger and thumb habits, but to an assist from the associated peri-oral musculature. With the increase in overjet, normal swallowing habits become more difficult. Instead of the lips containing the denture during deglutition, the lower lip cushions to the lingual of the maxillary incisors during function and at rest (Fig. 3). The maxillary incisors are forced still further forward, often with an additional assist from a compensatory tongue thrust. Abnormal mentalis muscle function and lower lip activity frequently flatten the

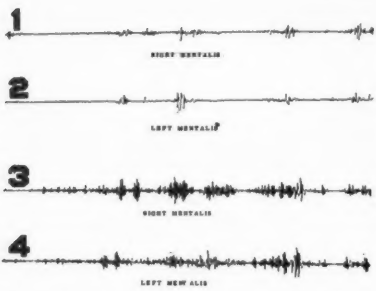

FIG. 4. Electromyographic recordings from Schlossberg, showing mental muscle function with normal occlusion and lip posture (1 and 2), contrasted with markedly greater mentalis activity in a patient with excessive overjet and abnormal lip posture (3 and 4). From Graber: Am. J. Orthodontics, January, 1958).

mandibular anterior segment (Fig. 4). Deformation thus proceeds in a more constant and concentrated fashion than with the most confirmed digit habit alone. This is a one way street to malocclusion. The real danger, then, is for the finger habit to change the occlusion and overjet sufficiently to allow the more potent deforming muscular forces to create full-fledged malocclusions (Fig. 5). It is these perverted forces that create the unilateral and bilateral crossbites so often associated with finger habits. The damage is very real. Duration of the habit beyond the third year of life is not the only determinant. Equally important are two other considerations. The frequency of the habit during the day and night qualifies the end result. A child that sucks sporadically, or just when going to sleep is much less likely to do any damage than the one who constantly has his finger in his mouth. Our case histories also show that the intensity of the habit is important. With some children the sucking can be heard in the next room. The peri-oral muscular function is easily visible. In others, the thumb habit is little more than a passive insertion of the finger in the mouth, with no apparent buccinator activity. Where the forefinger is the favorite digit, much more damage can be expected with the dorsal surface of the finger resting fulcrum-like on the lower incisors, than with the palmar surface hooked over the same teeth, but with the tip of the forefinger innocuously placed in the floor of the mouth (Fig. 6). This, then, is the tri-dent of factors that must be recognized and evaluated before the question of damage to the teeth and investing tissues is answered. Duration, frequency and intensity *must* qualify the conclusions of the psychiatrist, pediatrician and dentist on this important question (Fig. 7). The ini-

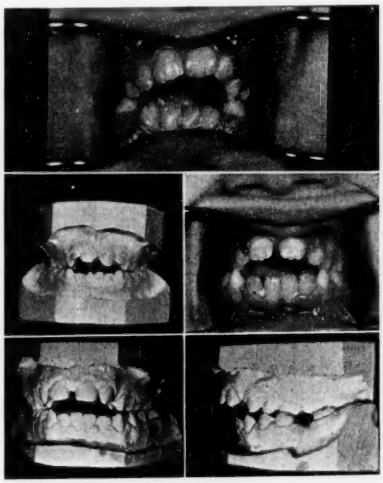

FIG. 5. Severe malocclusion in mixed and permanent dentitions, directly attributable to a long active finger sucking habit and abnormal peri-oral muscle function. (From Graber: Am. J. Orthodontics, January, 1958.)

tial morphology and inherent dentofacial pattern further condition any predictions on the ultimate occlusion. If the child has an inherent Class II, Division I malocclusion to begin with, damage from the finger habit and peri-oral muscle function may occur sooner, and to a greater degree.

Physical damage is not the only consequence of finger habits that have persisted beyond the third year of life. In almost all these cases, there is a clear history of unsuccessful attempts to break the habit, and the child is aware of the obvious displeasure of parent or parents. With some children, who actually want to drop the habit, but like other habit patterns, find it hard to do, this situation fosters an attitude of defiance or frustration—hardly the proper mental hygiene desired. With other children, this retained infantile mechanism serves as an attention getting mechanism. This situation is not conducive to domestic equanimity, particularly when the parent is aware of the possibilities of permanent damage to the teeth and investing tissues. With still other children, the finger habit may just be slow in disappearing. It is enjoyable, and the child has not transferred his pleasure getting to more mature activities. Perhaps the child has a slower rate of development and maturation than the median group.

FIG. 6. Fulcrum-like effect of index and middle finger is a very potent deforming mechanism. (From Graber: Am. J. Orthodontics, January, 1958.)

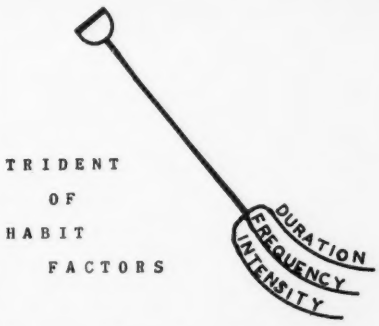

FIG. 7. Qualifying and equating factors that must be evaluated before attributing malocclusion to abnormal habit patterns. (From Graber: Am. J. Orthodontics, January, 1958.)

In any event, the dentist can render assistance. He can perform a valuable service for the mental hygiene of both the parents and the child, by preventing the creation of a permanent malocclusion, with attendant unfavorable health implications.

METHOD OF COPING WITH FINGER HABIT

After taking a case history (Fig. 8), the placement of an interceptive appliance is recommended. This is not to prevent the sucking, and at no time is the habit even mentioned to the child. The parents are instructed to ignore the habit completely. The stock response to all questions is, "This is a 'brace' to straighten the teeth." The actual aim of the appliance is to eliminate the kinesthetic, neuromuscular satisfaction and to render the habit meaningless. There are many appliances that might work.[9-14] The important design characteristic is that the cross-palatal bar be sufficiently removed from the palate to break the suction (Fig. 9). In addition, the crib should prevent any further deformation

CASE HISTORY

Patient ..... Age ..... Sex .....
Feeding during infancy
(a) Breast ..... How long? .....
When weaned to bottle? .....
(b) Bottle ..... When weaned to cup? .....
Sleeping habits
(a) Daytime naps, regularity, duration, etc. .....
(b) At night, number of hours, frequency of interruption, soundness, etc. .....
Unusual fears .....
Toilet habits and training .....
Eating habits .....
.....
Home conditions
(a) Siblings—number and age .....
(b) Mother's temperament .....
(c) Father's temperament .....
(d) Other persons in household .....
School adjustment
(a) Social difficulties .....
(b) Play habits .....
(c) Scholastic difficulties .....
General health of child
(a) Major childhood diseases .....
(b) Number of colds and minor ailments annually .....
(c) When does child get sick—winter, summer, spread out? .....
Response under stress .....
At what age did habit start? .....
Has it been continuous since then? .....
(a) Day or night, or both? .....
(b) During television? .....
(c) Frequency, persistence, intensity .....
What methods have been used to stop habits? .....
.....
Has child been nagged about habit by family or others outside? .....
Similar habits or history of habits of others in family .....
Attitude toward therapy .....
(a) Does child want to stop? .....
(b) Do mother and father both want appliance? .....
(c) Does child know purpose of visit? .....

FIG. 8. Finger and Thumb-Sucking Case History.

of the maxillary anterior segment. The spurs that project anteriorly are bent toward the palate. The posterior loop extends upward and backwards at a 45° angle to the occlusal plane. Usually, the maxillary second primary molars are crowned or banded as the abutment teeth. Appliances are placed in the late spring or summer, so that the child's energies are channelled into outdoor play activity, at a time when he is at his health peak and less likely to get sick and relapse into infantile mannerisms. The advantages of placing such an appliance before going to camp are considerable—there is the added benefit of group play therapy. Each appliance remains in place 12-18 weeks, after which it is reduced gradually. First the spurs are clipped, then the posterior loop extension is removed, and finally, when it is clear that the habit is inactive, the cross-palatal bar and bands are removed.

The results in 225 cases are gratifying.[15]

Females	129
Males	96
Age range	2½-18 years
Thumb only	174
Other fingers only	33
Thumb and fingers	18
Habit broken	207
Habit not broken	18

The high percentage of success is attributed to careful case selection and proper timing of treatment. No behavior problems were chosen, for the psychiatrist is first on the list here. Children of broken homes were not included in the sample. Parents that could not be relied on for cooperation prevented their children from being chosen, where this could be determined ahead of time. In other words, the sample was as "normal" as we could ascertain from the case histories and consultation with the parents. No appliances were placed in the win-

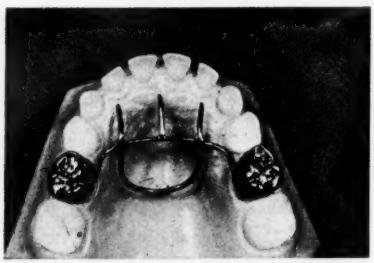

FIG. 9. Typical habit-breaking appliance, constructed on model. Spurs and posterior loop are bent toward the palate, but the base bar crosses the palate at the level of the gingival margin. Full metal crowns are carried below the gingival margin.

ter, for fear that a childhood disease plus the boredom of inactivity might stimulate regression to the more primitive mode of obtaining euphoria and security—the finger sucking habit. A more complete report on this study is in preparation now.

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25th Anniversary of the New York State Society of Dentistry for Children

THE New York State Society of Dentistry for Children was one of the earliest State Units of the American Society of Dentistry for Children to be founded. Organized May 9, 1933, its charter members were: Aaron Apfel, Theodor Blum, Walter A. Bossert, Harvey J. Burkhart, Waite A. Cotton, Wiler M. Dailey, George C. Douglass, Stanley M. Dow, H. Shirley Dwyer, Floyd E. Gibbin, Frank A. Gough, Thaddeus P. Hyatt, Joseph H. Kauffmann, Aaron Kaufman, Leonard Kohn, Abraham Lees, Harry H. Manville, Waldo H. Mork, Theodore O. Peterson, Florence Schroeder, Harry Strusser and Glenn H. Whitson. Now in its 25th year, the Society held its Silver Anniversary Meeting at Rochester, N. Y., on April 19 and 20, 1958, under the leadership of Robert Burchesky, President. When the meeting convened the other officers were: Abraham Kobren, President-Elect, Arnold Rosenberg, Vice-President, Charles F. Beck, Secretary-Treasurer and Joseph H. Kauffmann, Editor.

The Society's latest *Bulletin,* Vol. 9, No. 2, May 1958, carried on its front page the following inscription: "This issue of the *Bulletin,* published in conjunction with the 25th Anniversary of the New York State Society of Dentistry for Children, is dedicated to the advancement of the best possible dental and systemic health for every child in the world, without distinction as to race, creed, nationality, political, social or economic status." The *Bulletin,* first issued on a semi-annual basis in November 1949, is under the direction of the Publications Committee of which Joseph J. Obst is Chairman and Anthony J. Poggi, Business Manager.

In an introductory greeting, President Burchesky told of the Society's growth and the accompanying formation of local state subsidiaries known as the Metropolitan Unit (Manhattan, Bronx, Brooklyn), Westchester Unit (Westchester County) and Western New York Unit (upper New York state). The President stated that through the Anniversary *Bulletin* sent to all 12,000 members of the Dental Society of the State of New York (A.D.A.) he extended an invitation to every A.D.A. colleague to join the N.Y.S.S.D.C. An application card was enclosed with every *Bulletin.* In addition a cordial invitation was extended by the President for everyone to attend the Rochester Anniversary Meeting. In another short article the Secretary-Treasurer, Charles F. Beck, made a similar appeal to all A.D.A. colleagues and urged that every dentist should be a dynamic advocate of dentistry for children. In coordination with the theme of the Anniversary Meeting, the *Bulletin* contained a paper by Eugene J. North on "The Basis of Effective Prevention." The underlying thought was to emphasize the fact that true prevention is synonymous with dentistry for children.

As a special Anniversary *Bulletin* feature, written by invitation, Samuel D.

Harris contributed a message of congratulation to the Society. As the founder of the American Society of Dentistry for Children, in 1927, at Detroit, Michigan, Dr. Harris related some of the historical facts concerning the part played by dentists of New York State in the nationwide organization of our parent body. He told how dentistry for children had grown so that now the American Society of Dentistry for Children is the largest dental auxiliary in the world. His concluding words were: "The New York Society for Children is one of the truly bright stars on the dental horizon of organized service for children. May I express my congratulations for the Society's quarter century of light and guidance."

For the gala Silver Anniversary Meeting, following the Executive Council session on Saturday afternoon, April 19, there was held on the evening of that day a Banquet at the Hotel Sheraton which afforded a festive opportunity for good fellowship and which concluded with music and dancing made brilliant by so many of our gracious friends on the distaff side. What could we do without the ladies? Highlighted at the Banquet was the presentation of a certificate of honor to each of the Society's past-presidents. In some cases the presentation was made in absentia or posthumously to the widows of those faithful servants who had gone to the Great Beyond.

The scientific program, under the Chairmanship of Abraham Kobren, was an all day affair arranged through the labors of Harold D. Bowman and Roland R. Hawes of Rochester, to both of whom a magnanimous vote of thanks is due. No mere words could sufficiently express our gratefulness to these two esteemed colleagues. On the morning of Sunday, April 20, there was presented at the Rochester Eastman Dispensary, through the special courtesy of Basil G. Bibby, an array of table and projected clinics, and also numerous scientific exhibits. More than 25 highly qualified clinicians were the center of enthusiastic educational attraction at the famous institution devoted exclusively to the advancement of dentistry for children. After an enjoyable luncheon at the Sheraton Hotel, there followed the paper of the day: "Periodontal Problems in Childhood." Given by M. Michael Cohen of Boston, Massachusetts, it was a splendid talk illustrated with excellent photographs of valuable teaching significance. The afternoon was officially concluded with a Business Meeting for the entire membership. Upon departure of the hundreds who attended from all over the State of New York and neighboring states, there was no doubt left in the mind of anyone as to the overwhelming success of the entire celebration. It all was indeed a constructive and heartwarming step in the forward march of dentistry for children.

JOSEPH H. KAUFFMANN

THE NEW YORK STATE SOCIETY OF DENTISTRY FOR CHILDREN

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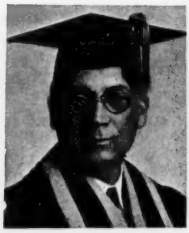

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1953-54

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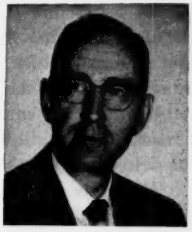
1954-55



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Internal Resorption or Caries?

A CASE REPORT

J. Randle Luten, Jr., D.M.D.

October, 1957.

Six year old, female, asymptomatic. No dental treatment except for extraction of lower right Primary Central to allow eruption of permanent central. Routine prophylaxis and x-ray examination.

Medical History:

(1) Dermoid cyst removed from above left eye at age 3 months. No recurrence.

(2) 1 inch linear fracture above left eye, age 16 months. Fell from crib. No complications.

(3) Usual childhood diseases. Temp. 104° for 1 day with measles, up to 105½° rectally, age 3½. One month later 105½°—Tonsilitis. Tonsils removed July, 1957, age 6.

First Examined on 4-2-56	X-ray No. 1
Subsequently on 12-10-56	X-ray No. 2
6-28-57	X-ray No. 3
10-4-57	X-ray No. 4

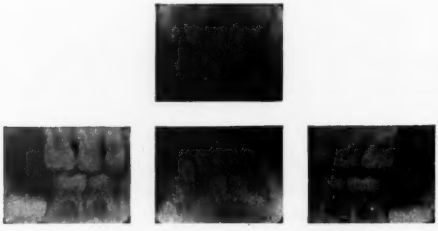
On third check up, the lower 6 year molars, unerupted, show a radiolucent area on mesial without any apparent external break-through. The fourth series of film show it even larger, especially in lower right. Still asymptomatic.

The following are two tentative diagnoses on the basis of the radiographs and history:

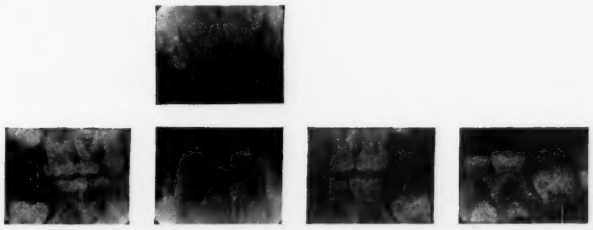
Dr. Galen Quinn, University of Tennessee: "It is my belief that this condition is internal resorption. An injury from occlusal trauma which destroys the follicular sac will allow the tooth to come into contact with the surrounding connective tissue. Osteoclastic action is initiated and destruction of the enamel and dentin follows.

X-ray No. 2

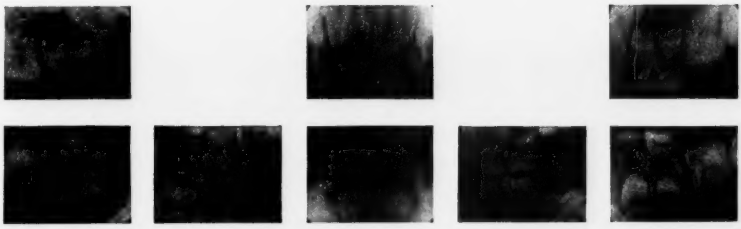
"The literature suggests a confusion between caries in unerupted teeth and this type of resorption. In the absence of a fistulous tract in the area, which might be very minute, the only possibil-



X-ray No. 1



X-ray No. 3



X-ray No. 4

ity is resorption. Teeth in close proximity to resorbing primary teeth will resorb in the same manner if the sac is broken.

"It could be either internal resorption or dental caries, but, of course, the determining factor would be whether bacteria could be demonstrated at the time of exposure."

Dr. Thomas K. Barber, University of Illinois: "I believe you are possibly correct on the resorption diagnosis but the more I look at the films the more I feel caries minded. Just prior to eruption there is a small break-through of the tissue in the form of a canal which easily allows entrance of bacteria into the dental follicle. I have repeatedly cultured swarms of bacteria from the follicles of unerupted teeth. The break through the enamel may be small enough to not be visible on x-ray."

Dr. Maury Massler, University of Illinois: "I agree with both of you: it may be an instance of internal resorption or dental caries, but unless cultures can be made, a definite diagnosis is impossible."

January, 1958.

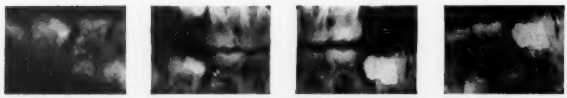
Becoming alarmed over the increasing size of this radiolucent area in the crown of an unerupted 6 year molar, a fairly radical treatment plan was devised.

11-23-57	X-ray No. 5	Before treatment
12- 6-57	X-ray No. 6	Day of treatment
1-11-58	X-ray No. 7	One month post-operatively

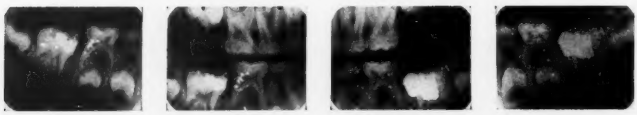
Treatment:

The unerupted lower right first permanent molar was treated first.

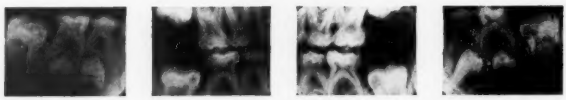
A one inch incision was made over the occlusal surface of the unerupted tooth. The tissue was retracted. Superficial bone and connective tissue were removed exposing the cornal portion of



X-ray No. 5



X-ray No. 6



X-ray No. 7

the tooth. No opening was visible through the enamel. Using diamond instruments under water spray and suction, an occlusal cavity was prepared in conventional manner. Just past the enamel a large, soft, tissue filled area was contacted. Laboratory specimens were curetted out. Upon removal of all soft tissue, the mesial enamel at cervical edge was extremely thin. A mesial occlusal cavity was prepared, then a vital partial pulpectomy was done as mechanical exposure resulted from curettage. Calcium Hydroxide mixed with local anesthetic was placed on pulp stump, covered with Zinc Oxide, Eugenol, Zinc Acetate mixture followed by stream of cold water to hasten setting. A conventional M O amalgam restoration was placed. Tissue flap was removed from occlusal portion of tooth. 000 black silk sutures were placed mesially and distally on edges of incision. The incised tissue edges were cauterized with Trichloracetic acid solution to retard healing over completely.

The unerupted lower left molar was treated identically except only an occlusal restoration and no pulpotomy were indicated.

This procedure was done under a general anesthetic in the office. Time: one hour and thirty minutes.

Lab Report:

(1) Culture from inside tooth reveals Streptococci.

(2) Microscopic section shows a minute portion of tissue taken from an area of unerupted tooth. This shows a loose fibrous type of tissue almost mesenchymal in nature.

There is no evidence of malignant change.

Recovery of the patient and healing were uneventful. The eruption of the tooth from x-rays No. 6 to No. 7 was quite rapid, stimulated by the operative manipulation.

Conclusion:

Even though lab report showed Streptococci present, a completely sterile tech-

nique during operative procedure was not attempted. The soft tissue mass inside the tooth was not indicative of caries. Therefore in my opinion and substantiated by Dr. Quinn that this is definitely a case of internal resorption.

Summary:

Radiolucent areas are seen in unerupted molars by many people who think nothing of it and are probably right. May be shadow or artifact on film, may be slight enamel defect of no serious consequence. This particular case startled me in that the small area became larger and larger. I was for waiting until eruption before treatment, Dr. Quinn suggested doing something before this, if nothing but Zinc Oxide-Eugenol dressing in the tooth. So the area was opened, prepared and filled and the patient is enjoying a healthy, treated tooth.

917 West 2nd Street
Little Rock, Arkansas

REFERENCE

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Aids in Pedodontic Prosthodontics

OSCAR E. BEDER, B.S., D.D.S.*

PROSTHODONTICS in children under certain conditions requires augmented procedures to insure a successful appliance. Such intervention is planned to emend existing intraoral structures to render them more suitable for the fabrication of the prosthesis. The structures may be modified, for example, by reduction or increase of bulk or contour, positional or dimensional change and substitution for missing tissue.

Basically the problems may be categorized as those of retention and stabilization, protection of existing structures, reestablishing vertical dimensions, providing adequate space for artificial teeth, malocclusion, and coordinating centric occlusion and centric relation.

Retention of pedodontic appliances generally involves the utilization of retaining devices. However, the normal contour and spacing of the primary teeth are not always amenable to the proper functioning of a prosthesis, especially if it is subject to leverage by palatopharyngeal musculature. The latter is particularly important in children needing an appliance to improve a cleft palate condition[1] (Fig. 1). Consequently, supportive procedures to provide retentive undercuts must be performed on strategic teeth, and would include the following methods:

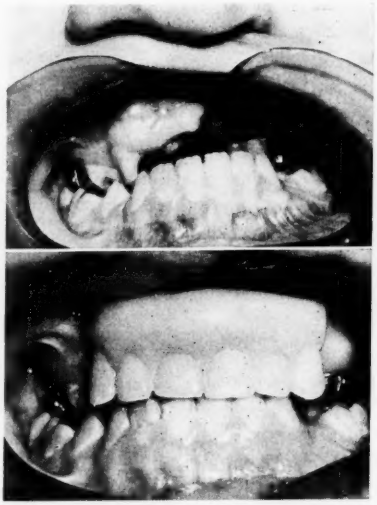

FIG. 2A. (Above) Cleft palate patient with orthodontic bands with spurs, cemented to maxillary molars.
FIG. 2B. (Below) Patient with appliance with wrought clasps.

FIG. 1. Maxillary removable partial denture with velar bulb contacting palatopharyngeal muscles.

Orthodontic bands—Bands are placed on selected teeth, following accepted orthodontic procedures. On the buccal or labial aspect of these bands are soldered small metal spurs to create retentive areas gingival to the spur. This pro-

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cedure is used in conjunction with wrought wire clasps (Fig. 2A-2B). A thorough education of the parents as to the absolute need for a continuously perfect cement seal of the band to the tooth is essential.

Prefabricated crowns—Preshaped crowns of various moulds can be applied to teeth lacking retentive properties. Such crowns can be modified by indenting the labial or buccal aspect to provide a retentive undercut in the area desired, usually in the gingival third (Fig. 3), and can be used with a wrought or a cast clasp.

Cast crowns—Unless contraindicated, full veneer cast crowns are the restorations of choice, as they afford full protection of the tooth and permit the revision of contours to provide the optimum retention, stabilization and reciprocal action of the clasp[2] (Fig. 4A). The clinical crown of the tooth to be clasped, by means of the wax pattern procedure,[3] can be rotated, inclined, increased or decreased in vertical and horizontal extent to improve vertical dimension and centric occlusion-centric relation equilibrium (Fig. 4B).

FIG. 3. View of crown with indented buccal surface.

FIG. 4A. Cleft palate patient with full veneer cast gold crowns.

In selected anterior crossbite cases, teeth may be moved by means of removable bite plane appliances. These can be quite simple, made of self-curing acrylic the bite plane of which is modified at each visit to direct the movement of the tooth or teeth under treatment (Fig. 5). The ensuing prosthesis such as the obturator should incorporate a retainer portion for the treated teeth to prevent relapse.

Unfortunately in some children, especially those with other medical problems, the teeth are beyond repair or modification (Fig. 6A) and must be re-

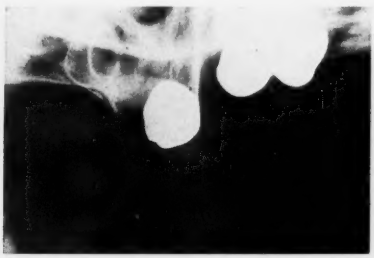

FIG. 4B. Radiographic photograph illustrating how clinical crown has been modified by means of a cast crown. Note inclination of root.

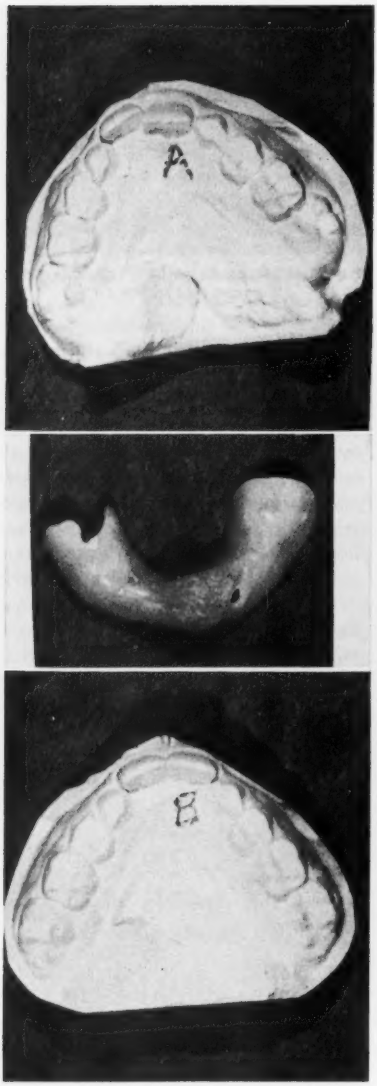

FIG. 5. Models illustrating how maxillary left central incisor was moved labially by means of the bite plane appliance in the center.

moved. In such cases, full maxillary and mandibular dentures must be fabricated to rehabilitate the patient (Fig. 6B). These may have to be modified or replaced as the patient advances in age, depending upon the growth potential.

Procedures on structures other than the teeth may be necessary before an artificial replacement can be completed. In some cleft lip and cleft palate children, the premaxilla may be so dis-

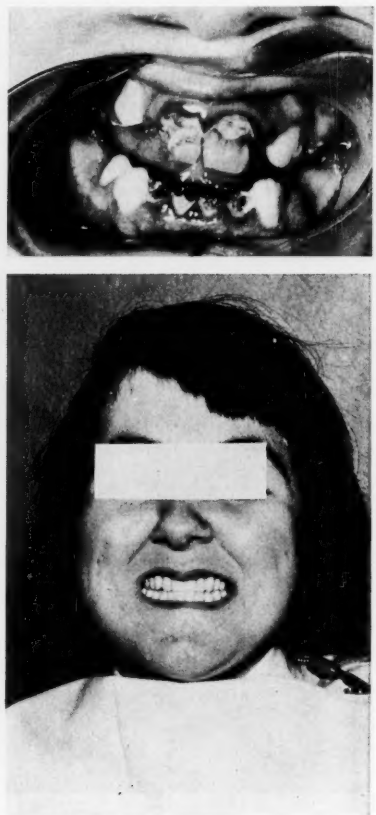

FIG. 6.

placed as to result in an inadequate intermaxillary space (Fig. 7A), or in excess labial bulk that precludes setting up of teeth at a satisfactory axial inclination and desired overjet and overbite. Thus, reduction of the bulk of bone is indicated (Fig. 7B-7C). In other cases, the malocclusion is such that the centric occlusion and centric relation do not register within normal limits of variation (Fig. 8A), and a forward thrust of the mandible by the patient is necessary in order to have the posterior teeth contact (Fig. 8B). In some of these patients circumstances contraindicate orthodontic treatment. When esthetics and phonetics are below average or particularly stressed by the patient the maxillary anterior teeth may have to be extracted, with a reduction of bulk of the premaxilla in the necessary area (Fig. 8C). This will enable the operator to improve the bite and function (Fig. 8D).

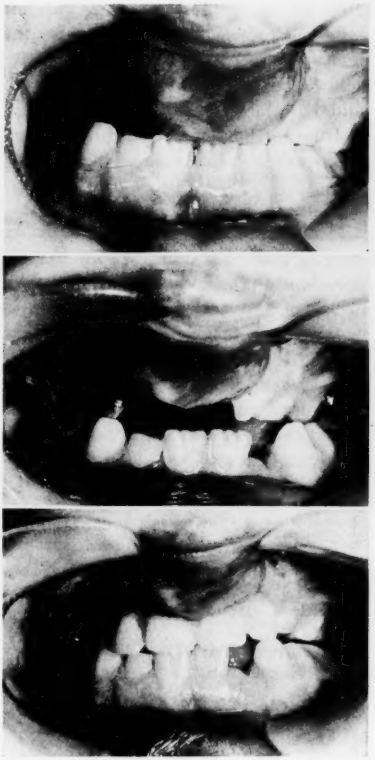

FIG. 7A, B, C, from top to bottom.

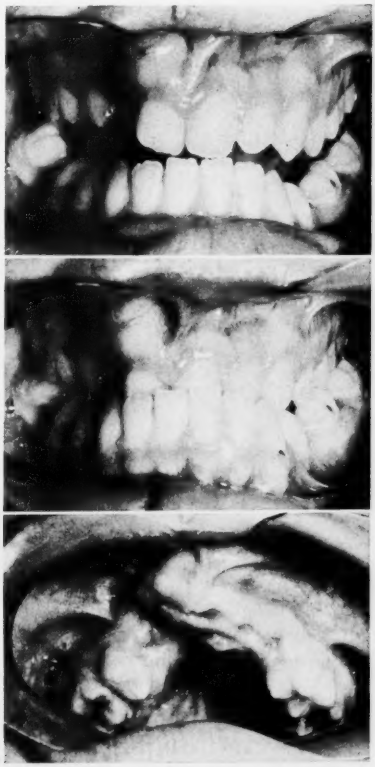

FIG. 8. A, B. C, from top to bottom.

Occasionally the corrective feature indicated for teeth must be incorporated

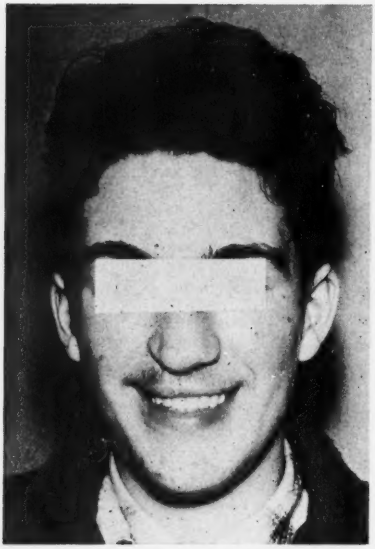

FIG. 8. D.

into the design of the appliance alone. An example of this would be in that for a patient who would not accept the indicated treatment plan that called for full cast gold crowns that would increase the clinical crown length of strategic teeth and thus increase the vertical dimension. A less desirable procedure may be utilized in which an extending acrylic flange from the denture is placed between two opposing molars to act as a stop, and thus open the bite. Occlusion of the artifical maxillary teeth with the natural mandibular teeth is thus established at the new dimension. In isolated cases, small temporary obturators may be added to orthodontic appliances to correct or reduce the existent dyslalia produced by openings in the palate (Fig. 9). Other infrequent procedures before denture construction include the fabrication of stents for skin grafting in the mouth and splints as adjuncts to mandibular surgery.

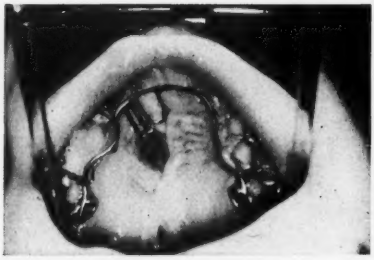

FIG. 9. Temporary obturator added to orthodontic appliance.

SUMMARY

Modifications of existing structures or designs may be indicated in certain pedodontic prosthodontic cases in order to attain the desired improvement in masticatory function, esthetics and phonetics. These may be in the form of additions to or reduction of tooth or contiguous structures in order to produce more desirable conditions of retention, stabilization, and dimensions.

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